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THE REMOUNT QUESTION IN THE UNITED STATES CAVALRY.

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First Cavalry.

THE breeding of horses in the United States has of late years confined itself largely to the production of three classes —trotters, thoroughbreds and draft horses—and the type of animal fit for ordinary saddle purposes, and from which should come our cavalry mounts, is being correspondingly neglected. There are in Tennessee and Kentucky, and certain Northern and Northwestern States, 'tis true, special breeders of saddle-horses, most of which are serviceable for cavalry use; but the cost of breeding these animals, owing to the large proportion of thoroughbred blood they contain, and, it may be said, the limited scale on which they are raised, renders them unavailable for our remounts.

This prediction in favor of special breeding has extended itself not only throughout most of the stock regions in the East, but also to the extreme States and Territories of the frontier. Western ranchmen in Dakota, Montana, Idaho, Oregon, Washington, California and (though we believe to a less extent) in the

more Southern Territories, are now freely serving their American, half-bred and "Cayuse" stock with Clydesdale and Percheron stallions.

Bands of horses in these regions that a few years ago contained many good half-bred American animals, and which formed the reservoirs whence Cavalry Purchase Boards then drew their annual supplies, now show in their stead a large preponderance of clumsy, coarse-limbed, work horses, which are totally unfit for such service. In many places in these States and Territories, with "horse-ranches" dotting the country in all directions, it is rare that a type of the clean-limbed, stylish, *real* cavalry horse is found. The writer knows from personal experience that Purchase Boards in Idaho, Oregon and Washington Territories are now almost wholly unable to get anything in the way of mounts equivalent to the liberal prices offered. The officers composing them, after distributing circulars far and wide in the neighborhood of their posts, or along the route over which they are to travel, will sometimes remain in session for many months in order to fill the annual deficiencies in a half-dozen troops of cavalry. The sums allowed for purchase are large ones (often as much as $150 and $175), and many horses are examined by the Boards, yet few thoroughly satisfactory purchases result from their season's work. The majority of animals presented are either base-bred "Cayuse" stock, the logy draft type mentioned above, or, in rare cases, blooded horses, beyond the reach of the allotted price. Finally the Board gets a "rap" from headquarters for delay, and is often thus forced into accepting animals which its own judgment forcibly disapproves.

The average cost per head of the artillery and cavalry horses throughout the different departments was for the last two fiscal years about $143. The records of the Quartermaster General's office will show how many of these horses are condemned soon after purchase and sold at one-third or one-fourth of their original cost to the Government. In several cases, which I have in mind, some of these purchases have died from exhaustion upon short marches within a month or so after being received into their troops. The trials of Purchase Boards in the respect just mentioned are not solely limited to those regions where horse breeders are rare. The writer was not long since on a Board in such a country as Southern Oregon, for instance—one famous in the West for its horses—and can testify to the Board's inability,

after months of labor, to get something less than a dozen ordinary cavalry mounts. The price allowed per head was $125, which should be amply sufficient for such animals as were needed, in a country well stocked with horses. The same complaints on this subject come from other departments of the Army. The testimony of many competent officers is that our system of supply is a faulty one, and a glance at the ranks of many of our troops certainly could corroborate it. Where is the defect and what the remedy?

I believe that those officers whose judgment on such points is best, and whose experience is far larger than my own, will agree that the defect lies mainly in the following facts:

1st. That special breeding in other directions is rendering it more and more difficult, each year, to obtain the proper type of cavalry mount.

2d. That the absence of depots in accessible places, to which raisers could bring their animals for sale, and the desultory manner in which Purchase Boards are compelled to travel through the country in search of material, is not a system best calculated to obtain such animals as *are* fit for the Service.

3d. That the fluctuating nature of prices, depending upon the amount of the yearly appropriations, is not calculated to encourage the raiser to seek the Government market. A dealer who is offered only $125 for an animal for which another Board, more liberally supplied with funds, would have the year before given $150, is naturally disgusted and inclined to seek a more equable mart for his wares.

4th. That officers are rarely put upon Purchase Boards with regard to special fitness therefore, and that the changeable character of the yearly boards allow few to ever become experts. In European cavalry the "remount officer" is selected from those specially trained in hippology, and fitted by their knowledge of the horse and of the tricks of dealers, to competently purchase him. The services of such men are highly valued, and they are continuously kept in demand. By this means their knowledge of the market, and their relations with the different dealers, remain unbroken from year to year, with obvious advantage to the Government.

Now the remedy for these defects would seem to lie in one of two alternatives.

I.

PURCHASE SYSTEM.

The first is one suggested by Capt. Geo. E. Pond, Quartermaster's Dept., and A. Q. M. to and member of the Purchase Board for the Division of the Missouri in '84. He points out in a letter to the Q. M. General, which the latter publishes in his annual report for '84, several of the faults mentioned above, laying especial stress upon the first two. To obviate these, he proposes the establishment at Leavenworth "of a general horse depot, on the same plan of general depots of the Quartermaster's Department, for supplying the whole Service with all animals for cavalry, artillery or draught purposes; this depot to be directly under the Quartermaster General, and to have in stable a sufficient number of animals to meet the ordinary demands of the Service, say 250 or 300. Then, as animals are wanted they could be supplied on approved requisitions, the same as other stores, and the reserve filled up by purchase (in open market or by contract). The Government owns a large and valuable reservation at this place, most admirably adapted for this purpose. A comparatively small outlay (say $15,000) would build the necessary stables, etc.; a large part of the year the animals could graze. By careful management, with aid from the labor of military convicts, the necessary hay could be cut, and even the forage be raised for the use of the depot on lands owned by the Government.

"The officer in charge should have authority to purchase animals when needed, and could take advantage of the market, if the present system is retained, and in a short time farmers and raisers would bring their stock direct to him, and being under no immediate necessity, he could select only the best. Animals could here receive a preliminary training, be thoroughly broken to the saddle and, besides, be properly shod, so that when a requisition came for any regiments, a mount of sound, acclimated, trained and colored horses could at once be sent in a solid shipment."

Capt. Pond also objects to the Purchase Board of three officers as being cumbersome and productive, from the lack of unanimity of opinion which often exists among them, of delay in the transaction of business. He likewise makes some suggestions as to a Government breeding station, which subject will be noticed further on. As to his main proposition, the establishment of a general purchase depot, few will deny its practicability or advan-

tage to the Government, providing that the breeding system is not adopted. Leavenworth, Riley, or some other central point or points at which the Government reserve is sufficiently large, and which would combine the further conditions of accessibility to horse raisers and routes of travel, cheap forage and good grass and water, would, of course, be the proper places of such depots. As far as climate goes, we would prefer the cold, bracing atmosphere of Kansas, Colorado, Wyoming or Montana, to more Eastern or Southern regions, irrespective of the advantages they afford as central points. It is well known that some of the best and hardiest animals in the West are raised in the most Northern latitudes of the Territories; but at the same time the expense of extra feeding and shelter during an increased length of winter, would render it unadvisable to seek any spot subjected to too great a severity of climate. Our idea would be to have several of these depots; one, say at Riley, one in Montana (near Helena), and one at some point in the Southwest, accessible to the cavalry stations of Arizona and New Mexico. We would thus obtain a larger surface of supply, save many thousands of dollars in transportation, and have our herds in convenient sizes for handling. If, however, but one central depot be established the officer in command of it, wherever placed, should be of high rank and long experience in his corps; he should be a *cavalryman, par excellence*, with a thorough knowledge and sincere love of the horse. None other could secure the administration needed to make a success of such an establishment. The use of the italicized word "cavalryman," does not contemplate an officer "officiously partisan" or bigoted, as to his own corps, but means an officer thoroughly imbued with a love for good horseflesh, an interest in the stables and that cavalry *esprit* which all true officers of the mounted arm must possess. He should have the supreme immediate control of his depot, and should, with his command, be entirely separated from service with any other corps, as far as the duties of his garrison are concerned. The attempt to amalgamate the functions of the several arms, has caused some of the most deplorable defects that have ever existed in our Army, and would be fatal here. Given such a commanding officer, he should be assisted by an able corps of subordinates, selected in the different grades, for their interest and skill in everything pertaining to the horse. These latter officers should, with the exception of the necessary guard and court-martial details, have nothing but the legitimate duties

of such a depot to occupy them. A battalion of cavalry large enough to furnish, if possible, one private trooper for each two horses at the depot, should be barracked in proximity to the stables, and limited, like the officer, as much as possible to the duties strictly incident to the care of the horses and stables of the depot.

A Purchase Board composed of three cavalry officers of recognized expertness and ability for such a position should be established, and should be as nearly permanent as possible. Four years is the least limit which such a Board should have, in order that it may thoroughly learn the markets, merits of the different dealers, and, generally, those things about their business which only long experience will perfectly teach.

An officer of the Quartermaster's Dept., or one acting as such, might be attached to this Board as a fourth member, to be charged only with the disbursements incident to purchase.

Ready money should be paid on the spot for each animal bought.

To this depot it is believed that in a short while an ample number of horses, fulfilling the required conditions would be brought each year. If there proved at first a deficiency due to a lack of horse-breeders in the vicinity, this would be remedied erelong by the increase in the number of such breeders, which the inducements of the market thus afforded would give rise to.

Animals should, in our opinion, be bought into the depot at the ages of 3 and 4 only. The minimum of height for the first age should be about 14¾ hands, and for the second 15 hands. They should correspond to the conditions laid down in the regulations for purchase, in all particulars, save those of age, height and weight, in which the figures should of course be decreased for the younger age.

They should be shown broken to the saddle when bought, and should possess that build, which in a young horse gives promise, to the experienced eye, of fine high action—the action needed for a typical cavalry charger. They should be kept one year at the depot, where they could be thoroughly bitted, broken to cavalry gaits, assorted in colors, and shipped to the different regiments thoroughly fit for service. These animals thus purchased could, both on account of less age and the fact that dealers could afford to sell reasonably to so large and steady a market, be bought at a large reduction on the present prices for full-grown horses;

let us say at an average discount of 25 per cent., which is, we think, a fair estimate. Then a 6-year old, say, costing, at existing rates, $140, would come, at 3 or 4 years, to something like $110. Adding to this the cost of keeping the animal one year at the depot—which should be very small in a country of cheap forage like, say, Kansas—we can at once see the saving in a pecuniary way to the Government.

Of course, in shipments made from the depot to remote cavalry stations, the large transportation charges would materially cut down this saving. It must be remembered, however, at the same time, that the present cost of shipments from the East to many Western points would thus be saved.

I advocate purchase at the ages of 3 and 4, because at 5, or older, a horse is generally too confirmed in habits and disposition to receive the highest benefit from such drill and training as this depot would afford, and younger than 3, the colt would have to be kept at least two years at the depot before being fit for service; and the expense and trouble of keeping and educating him during this time would render purchase at such age undesirable.

It will be observed that the system just proposed would send some 4-year-olds into the different regiments, but unless they be called upon for an unusually arduous campaign immediately after their entry into service, this objection will not be found a serious one.

It would, in case such a depot is really created, be wise to establish it with a view to permanence. The stables and barracks should be durably built and judiciously planned. The former should be no make-shift "shanties," but commodious, well-ventilated buildings—stone if possible—with good floors, improved mangers, loose boxes, convenient hay, grain and saddle rooms; in other words, stables built with all available precautions for the health and comfort of the animals they contain. It would take but a trifling additional outlay to secure these and make them all that model military stables should be.

At least two large riding halls should be erected, as they will be absolutely necessary for winter work. Steeple courses and riding tracks could, of course, be laid out anywhere and without much outlay of time or trouble. Whether Congress would appropriate a sufficient sum for all of the buildings needed would seem to be the only question upon which the ultimate success of the establishment would depend. The absolute amount needed

to start it would not be large, in fact, would be actually insignificant in comparison with the value of the results it would secure to the Government. Supposing no special school of cavalry to exist, the officers, below the rank of field officers, stationed at the depot should have the benefits of a course in veterinary surgery and horse-shoeing. Nowhere better than at such a place could opportunities be found by our officers to prosecute those rare but valuable studies. They could, under the instruction of several of our best veterinary surgeons, specially detailed for the purpose, gain here that technical and practical knowledge of these details of their profession which would not only add to their efficiency as mounted officers, but which would stimulate a professional interest in such matters, that would be of incalculable benefit to our Mounted Service. It is hard not to digress and go into all the possibilities in the way of professional advantages which could be derived from such an establishment properly managed. It could, leaving out other considerations, remedy nearly all the defects, which, despite our many practical accomplishments derived from West Point and frontier training, now exist in our technical knowledge of the horse and his treatment.

Each animal, as soon as he is bought into the depot, should be turned over to a trooper, who, if possible, will be specially and permanently in charge of him, as regards grooming, handling and riding. The tempers and capacities in horsemanship of the men should, in as large a measure as possible, determine their selection for the different horses. The latter, at first equipped with the saddle and snaffle, should be drilled for some weeks in the school of the soldier (in small squads) in the halls and in the riding schools. This preliminary training should be for the purpose of "mouthing" the horse properly, teaching him obedience to the leg and quiet behavior. In this instruction, therefore, it is requisite that gentle gaits be solely used, and that each drill is under the personal supervision of a careful officer. It is too often found that many young animals sold by Western raisers as first-rate "saddle-horses," have a large education still to gain in the rudiments just mentioned.

After these first few weeks of drill the curb bit is substituted for the snaffle, and troop and battalion drill still further continues the horse's training for the ranks. In the winter, instruction should be carried on in the halls, though, of course, to a more limited extent, and in the spring an occasional tour over the

steeple course, commencing with easy leaps, teaches the animal what so few of our Service horses are now capable of—the art of going "across country."

At the end of such a year's training can it be doubted that this animal will exhibit a more satisfactory type of cavalry horse than we now ordinarily find in our ranks?

The above is, without going too much into detail, a sketch of our idea of what a general *Depot of Cavalry Remount* should be. With a reasonable appropriation and a vigorous interest in the subject on the part of the proper authorities, such an establishment could not fail to be useful and in all respects *practicable*.

II.

BREEDING SYSTEM.

We now come to the second alternative in the shape of a remedy, which is that of a breeding farm, maintained and controlled by the Government itself. Such a plan has, undoubtedly, with its many merits, some serious objections. In the first place, if the farm be started on a basis large enough to enable it within the first five or six years to supply from its own stables the entire yearly quota of horses needed for the Cavalry Service, a much larger preliminary outlay would be required then for establishing the purchase depot. The cost of the number of stallions and mares necessary to commence on such a scale, and of erecting suitable stables, etc., for these and their first season's foals, would evidently be the most formidable items of this first expense. Another difficulty would be the lack of sufficient pasturage on most of the reservations which the Government now possesses, and which are otherwise suitable for the purpose, to accommodate the large number of animals which would accumulate on the farm at the end of two or three years; and still another, and by no means the smallest obstacle, would be the difficulty of securing the service of officers competent to successfully manage such an undertaking. If there are any officers in the world who possess versatility of talents, and the faculty of making themselves readily expert upon subjects which are difficult and unfamiliar, they are the officers of our own Army. But in this particular case, some experience and previous knowledge of the theory and practice of horse-breeding are absolutely necessary qualifications for the officer in charge of the farm; and of course they would be most desirable attributes on the part of his assistants. It is probable

that officers with these requisites can be found in our cavalry, but they do not grow on every bush, by any means. A careful selection of the officer in command, at any rate, would be a *sine qua non* of success. An officer of rank, of some experience and ability in such matters, a true horseman himself, and one bringing a sincere interest into his work, would, with reasonable facilities at his command, insure good results from the farm; one placed in command of it simply through favoritism, or because "his high rank entitles him to it;" one indifferent to the horse and without enthusiasm as a horseman, is equally certain to insure a wretched failure.

The commanding officer should be privileged to visit the farms, and study carefully the systems of some of our noted breeders, like Gen. Harding, of Belle Meade Farm, Tenn., Mr. Alexander, of Woodburn Farm, Ky., and others. He should learn from such men and the large Western raisers, all the points regarding breeding, feeding, hygiene, etc., which would be valuable to one starting in such a business without a thorough experience. He should have the services of the most competent veterinary surgeon in the Service as his adviser, and should neglect nothing which could assist his own knowledge in the administration of the farm. He should give his stables, paddocks, and the training grounds his daily personal attention, and should be competent to detect and remedy at once any defects here or in the general management of the mares and foals. Could such an officer be found, the objection last cited to the farm system would largely disappear.

To offset the drawbacks to this system, is the fact that it would, properly managed, give us the very best quality of mounts obtainable for cavalry service, that a farm of moderate proportions could easily supply the yearly requisitions from the various regiments, and that when fairly started such a farm, as we shall attempt to show, will prove more economical than either the present purchase system or the one discussed in the beginning of this paper. There is, too, a powerful element of success for the breeding system in the favor which, we believe, the Lieut.-General of the Army bestows upon it. It is understood that it has received his approval on numerous occasions, and that it has been his wish for some time to establish the farm at Ft. Riley. Under encouragement from so high a source, and with the advantage of so good a selection as to site, this farm would be born under most

happy auspices. Given an appropriation sufficient for a proper start, a good location with abundant pasturage, a *competent management* and the *favor* and *influence of the proper authorities*, and I would unhesitatingly declare for the breeding system against any other. The scale of this article will not admit of any elaborate inquiry into all the details of horse-raising, and still less of the cost of buildings, feeding, fencing, etc., in connection with so large a breeding establishment. A discussion in *extenso*, of this sort would, besides, be beyond anything which my experience would attempt. I can claim, however, besides a constant interest in the subject for some years past, the advantages of a close attention to foreign military breeding systems and of extensive correspondence, personal and otherwise, with some of the most famous raisers in Kentucky and the West.*

The following ideas as to a farm suitable for supplying our Service horses are based, therefore, largely upon the experience of others. I have sought information only in the most reliable quarters and have rejected much that, while applicable to the luxurious circumstances of wealthy raisers, or to the raising of fancy thoroughbred stock, would be unsuited to the conditions of any farm for the Service. The object to be attained by the latter should be, as we take it, *the rearing of a good-sized, hardy, spirited and sound type of cavalry horse at the least possible expense to the Government.* A suitable place having been determined upon, the first question we should naturally ask would be, "On what scale shall we commence?" or, in other words, "What yearly demand is our farm to supply?" Looking into the Quartermaster-General's annual reports, we find that the yearly average of horses required for the cavalry is about 1000. The first query would then be, 1st. "*In order to supply a quota of* 1000 *animals per year, what number of stallions and mares shall we purchase as a beginning?*"

It is evident that we must be limited by economy on one hand, and on the other, should commence on a footing sufficiently large to make the farm the sole source of supply for the Service, within a reasonable number of years.

We think that both of these conditions can be most nearly fulfilled by commencing on a basis of 1000 breed mares and 20

* Among those in Kentucky, I am especially under obligations to Mr. Brodhead, of Woodburn Farm, and Mr. Railey, of Midway, for a great deal of valuable information.

stallions. This will give 1 stallion to every 50 mares, which is accepted as about the best proportion for strong offspring.

Leaving aside for a moment the quality and cost of these, let us examine the possibilities as to issue from this number of breeders.

Let us suppose the animals put on the farm before the May season of the year, in time to be served by the stallions on the ground. We will then calculate upon a "get" for the next spring. In this calculation we will premise that 75 per cent. of the mares—a moderate estimate—will successfully foal. Allowing a margin for disease and accidents to the young animal after birth, let us say that 70 per cent. of the mares will each year produce foals which will afterward reach the age of 5 years and be fit for cavalry service.

With 1000 mares and 20 stallions this will give us, for the successive years:

	Yearly No. of Foals.	Total on Farm (original Mares, plus Foals.)
End of 1st Year,	700	1000 + 700=1700
" 2d "	700	1700 + 700=2400
" 3d "	700	2400 + 700=3100
" 4th "	700	3100 + 700=3800
" 5th "	700	3800 + 700=4500

The first season's get are now 4 years of age and the fillies of that year are, therefore, old enough to breed. in addition to the original mares. Let us suppose that these fillies represent 50 per cent. of the 700 of that season. Counting their progeny in at the end of the 6th year (one year from the time they are put to the stallion), and doing the same for the fillies of the following years, as they successively arrive at the age of 4, we have:

	Yearly No. of Foals.	Total on Farm (original Mares, plus Foals).
End of 6th year.	945	4500 + 945= 5445
" 7th "	1170	5445 + 1170= 6615
" 8th "	1415	6615 + 1415= 8030
" 9th "	1660	8030 + 1660= 9690
" 10th "	1905	9690 + 1905=11595

The next season we get the grand issue of the 1st season, and so on.

We have now, at the end of ten years, arrived at an average of 1900 foals yearly.

Estimating 50 per cent. of these to be colts,* and rejecting

* The word "colt" is often very loosely applied. The offspring of the mare is, properly, the *foal* immediately after birth. From that time the males are *colts*, and the females *fillies*, up to the age of 5, when the animal of each sex is said to be grown. The male is then the *stallion*, *horse* or *gelding*, and the female, the *mare*.

two fillies (which are unfit as future material for cavalry), we now have, in other words, an annual yield of about 1000 *colts*, or a number just about large enough to supply the quota of geldings needed for the Service each year. We also see that we would have at this time a total of 11,595 on the farm, supposing us to have kept all our original stock and its progeny. But we have *not* done this; we have replaced some of our original mares and stallions by younger breeders of their own families, and we have supplied, in the meantime, some 1700 fine, well-trained, 5-year-old geldings to the Service—the product of the colts born during the successive years, from the 1st to the 6th, inclusive.

Evidently, however, 10,000-odd animals is too large an establishment for the supply of only 1000 animals yearly. The unnecessary surplus is due to our having kept on hand all the *fillies* born in the different years. As these are not fit for cavalry use, and since only a comparatively small number are needed each year to replace the older breed mares as the latter outgrow their usefulness, it is evident that we must dispose of this surplus. There are two ways of doing so—either by public sale (when they become yearlings say), or by following the example of foreign cavalry services and utilizing both mares and horses for the ranks. By this last method everything would be fish that came to our net, and our production on the farm reduced to the most economical scale.

We will suppose, however, that the present system of using only geldings be carried out, and that the surplus of mares be disposed of by the other alternative of sale. Our next question, then, would be:

2d. *What average number of animals would we have to maintain on the farm at a time to produce, annually,* 1000 *colts?*

Reckoning always that about 50 per cent. of each year's issue *are* colts, we find that a yearly number of, say, 2800 mares and 50 stallions is necessary to keep up this supply.

Supposing the fillies, except those needed as breeders, to be sold as yearlings, and the males to be sent to their regiments at the age of 5, we should have an average yearly total of between 8000 and 9000 animals present on the farm—figuring approximately.*

* As has been suggested for the purchase depots, there might be two, or even three, of these farms distributed in such parts of the country as furnish the best advantages, thus dividing our herd into smaller and more readily managed bands. The French maintain on this principle three cavalry *harus*, or breeding farms, with excellent results.

It is observed that the plan sketched above necessitates the system of in-breeding, through and through. This we would by no means consider an objection. Few of the best authorities on horses now so regard it, and some of them are even outspoken advocates of it.

Mr. Brodhead, manager of Mr. Alexander's farm, of Woodburn, Ky.—one of the most successful raisers in the world—says, in answer to an inquiry I made of him recently on the subject: "I like in-breeding; it is the only way to establish a type. On common mares you could put three or four crosses of stallions of the same family and have the same characteristics. In fact, this could be done indefinitely by judicious selections. You can hardly in-breed too much to a good thing." Besides being unobjectionable, as far as its effect on the quality of the breed is concerned, in-breeding is obviously the most convenient and economical system for the Government, as it avoids that constant attention and care which the plan of crossing would require in the separation of animals, keeping records of pedigree, etc.

The next question which suggests itself is:

3d. *What character of stallions and mares (as regards blood and price) should we select as breeders?*

This is the point on which the advice of experienced breeders is more conflicting thad any other. Some recommend thoroughbred stallions, of a certain strain, upon half-bred mares; others, the same stallions upon three-quarter-bred, or thoroughbred, mares. One urges the importation of "Cleveland Bays," to be crossed with American mares; another, thoroughbred American (not imported) stallions upon cold-blooded females. The last is the plan proposed by Mr. Brodhead, and the one which seems to us best. Keeping in mind the type of horse needed for cavalry purposes—strong, big-barreled and hardy—we can easily see the objection to a *full* strain of pure blood, carrying with it, as it usually does, a nervous, high-strung temperament, sensitive organization and light build. It is also evident that an opposite extreme—that of a stolid, dull, heavy-limbed brute—is equally to be avoided. What we want is that judicious blending of blood which will produce the proper combination of the qualities of the two types—the spirit, activity, gracefulness of the one, with the hardiness and strength of the other.

If we select our sexes from American thoroughbreds the best method would probably be to buy up racing stallions retired from

the turf for accident or other cause. Even those retired for age would for many years answer our purpose, as up to 20, and often after, their breeding properties would be unimpaired. A requisite number of such animals could readily be procured at a cost of from $1000 to $1500. The 20 stallions which we would need in the beginning would thus cost us between $20,000 and $30,000.

As for type, we would select some such get as that of Phaeton, Ten Broeck or King Alfonso,* which strain is abundant in Kentucky to-day. It is noted for its strength, speed, docility of temper and perfection of form.

In choosing our mares to breed to such stallions we would advocate cold-blooded ones for the following reasons: they are cheaper, they give, with such a cross, the happy medium for cavalry use spoken of above, they breed more surely, and require

* These stallions are said to impress themselves wonderfully upon their progeny. Phaeton died in '72; Ten Broeck and King Alfonso are still living, and are the property, respectively, of Messrs. Harper and Alexander, of Kentucky. King Alfonso is said to stamp his get even more surely than Ten Broeck, and is a very sure breeder. His picture, sent me by Mr. Alexander's agent, is before me as I write, and shows the perfect model of a cavalry horse. The following is his description in Bruce's Stud Book:

"King Alfonso is a red bay, 16 hands, with a star in his forehead, and is one of the truest and best-shaped horses in the world; his head is plain, but well shaped and set upon a good, strong, muscular neck, with wide, deep throttle, the shoulders oblique, broad and well placed, and covered with suitable muscle; the chest is well shaped and full, with great depth of girth; the body full and round, with the finest back, hip and loin ever put on a horse, being broad, well rounded, and slightly curved. He has great length from the point of the hip to the whirl bone, thence to the point of stifle and hocks, being full of strength and muscle which run into broad, powerful hocks, the legs and feet being sound and good. His temper is of the best. In addition to his double cross of Glencoe, he has the waxy blood through Web, Whisker and Whalebone, and is in-bred to Sir Archy and imp. Shark, with many crosses of Herod and Eclipse in collateral branches."

In addition to the above, the eye of a cavalryman would note the following features:

His back is short and straight, with the saddle place beautifully situated, it being as nearly as possible in the middle of the back. He has plenty of room beneath the belly. In other words, his back is a powerful one, and little apt to be sored by the saddle; and the length beneath tells of speed and free action. Such a horse can never be awkward or "tied up" in his movements.

His legs are models. His fore-leg is not, as with many racers, too long for a military saddle horse; it is flat, finely muscled, and with a proper proportion between the relative lengths of fore-arm and lower portion. His legs stand well under him, and the hind ones, with the same beauties, in point of flatness and muscle, as the fore ones, are exactly proportioned in length to the latter. They are just long enough to serve their purpose as powerful propellers, and not sufficiently so to raise the hind-quarters beyond the line of symmetry of a flat back.

less attention than thoroughbreds. We could buy the proper type of such mares, good sized, sound, strong, well proportioned and good breeders, for from $150 to $200, in Kentucky or Tennessee. Thoroughbreds would cost just two or three times as much. These mares should be bought from 4 years of age up to 10. They would, in health, be perfectly adapted to breeding up to about 22 years of age. Served by a stallion of about 16 hands, mares of about 15½ hands would probably give us the best size for cavalry. They should be chosen from a region possessing a large portion of well-gaited saddle-horses, such as the two States above-named. The issue in such a case, would be much better saddle material than if their dams came from Western ranges where the stock is but rarely well broken to the saddle. The perfect saddle gait has to be *bred* in the animal, and nowhere is it really inherited except in those States where the raising of saddle-horses has been a long-established business.

As for any fears, on climatic grounds, regarding the health or breeding properties of animals taken from the Eastern States to Western ranges, we do not believe them to be well founded, as the testimony of many Western raisers of repute who have tried the experiment asserts it to be a safe one. Mr. W. H. Raymond, a large raiser near Virginia City, Montana, who has imported some very fine Kentucky stock, and who for some years has been not only one of the best posted, but one of the most successful breeders in the West, writes me that he has brought Kentucky mares upon his farm as late as November, and that they wintered perfectly without any other feed than that furnished by the range. Others have told me similar experiences. Of course, in individual cases it may sometimes prove otherwise, but believe the liability to accident from change of climate alone to be extremely small. Our breeding farm should be established at such a season that the mares may be served by the stallions in April or near the 1st of May. About the last period would probably be the best for a climate like that of Riley.

From the above calculations, it is observed that our outlay on the number of breeders (stallions and mares) necessary to start our farm on the proper basis is only about $200,000—a sum but little in excess of the yearly appropriation for cavalry and artillery horses as at present purchased (the sum for 1884 was $186,731, and for 1885 $203,370.

The last question we will consider is:

4th. *What would be the cost of rearing an animal on such a farm as we have designed?*

The answer to this naturally involves, to a large extent, the practicability of our undertaking, as far as pecuniary considerations go. To an enthusiast in horse culture it will be difficult to discard all idea of fancy stables, model paddocks, and luxurious appliances. His love for a fine animal would naturally prompt him to bestow a refinement of care and attention upon him and to surround him with all the elegance which could gratify a fastidious taste. But in our case no such fancies are allowable. The problem before us is to get the best possible mount at the smallest possible expense. In the case of a purchase depot with but a couple of thousand animals, improved stables and their accessories would probably have been feasible, but here, with some 8000 or 9000 horses, they could not be thought of. It is well known that many raisers in Kentucky, and in even the colder regions of the West, make their stock "rough it," in the strictest sense of the word, all the year through. Neither mares nor foals are ever stabled on their farms, and in some cases even the young animals after being weaned are left to get their living from the pasture during the following winter. Mr. Raymond, who has already been quoted above, says: "As to cost of raising a gelding, it would not cost any more than to raise a steer, after he is weaned. I never feed them. The best mares I have, have not been fed 10 bushels of oats in 10 years. They simply run at large on the range." It must be understood that this gentleman is a breeder of thoroughbred, catalogued horses. He pursues his business, too, on a large scale and in a climate by no means mild in winter.

Despite the above authority, however, I am not convinced that this system of raising should be strictly imitated by the Government. Many other breeders acknowledge that the system of no feed and no shelter during the whole year prevents the fullest and most perfect developments of the animal. They assert that a very hard winter will, under such circumstances, stunt a youngster, and we know they are occasionally lost through exposure in such seasons. A certain amount of food and shelter, is, we may say, then, necessary for both the young and old animal. Accepting this as a premise, I would suggest the following system in rearing:

Our farm should be divided into large fields, capable, each,

of containing, say, a couple of hundred mares. The stallions should have, each, a box stall, and there should be suitable corrals in which mares might be served, and young animals handled. After the mares have been served in the spring let them be turned to grass in their respective fields. If the latter are sufficiently large, and the grass good, they will need little other food until, say, December. At this time their condition of pregnancy and the state of the grass, would render an additional supply necessary. In each field there should be substantial sheds or open stables, the opening toward the south. These should have hay racks and feed boxes and be large enough to contain all the animals in that field. They would furnish shelter in the winter, or seasons of storm. In these the mares are now driven each evening. They receive a small feed both then and in the morning, and are turned out to pasture again the following day. Each of these fields should be under the constant care of an experienced non-commissioned officer assisted by a proper detachment of non-commissioned officers and men. This system of sheltering and feeding the mares will continue until the grass is good in the spring, When, about this time, the animal shows signs of foaling, she is taken to a loose box where she is kept for a day or so after delivery. She and her foal are then turned out to pasture and little further attention need be paid to either until the fall, when the youngster is weaned. The latter deprived of its mother's milk, should from this time until the following spring have a regular daily feed of hay and grain, for its proper growth at this period is of the utmost importance. It is assigned its separate place and manger in one of the open sheds. All the fillies (except those retained for breed mares) should be sold the following spring, as already suggested. The yearling colts are at th time again turned to pasture and left is entirely to grass (if it be abundant enough) until the succeeding fall. This treatment should be followed each year until the last six months previous to their shipment to the regiment, which would probably be in the early summer. During this period (the animal has, of course, been previously broken) they might with advantage have the feed increased to the regulation allowance and receive daily grooming. This would fill the horse out and permit his entry into the troop with a fine exterior.

Supposing the forage supplied to be cheap, say grain at 1 cent and hay at 5 cents per pound (a probably fair rate to assume

at a spot where such large quantities would be sold at contract prices), and calculating that a half ration of grain, and two-thirds ration of hay, be fed the animals daily during 6 months the first year, and during 5 months each succeeding year, we find that the actual maintenance of the animal under the above system has cost, up to the time he is sent to the regiment, only the modest sum of $85. This calculation leaves a small margin and includes almost the *total* actual cost of the animal himself, as on a Government farm the labor would count for nothing.

Compare this method, which gives us a real cavalry horse, well broken, and of blood and soundness which we can ourselves vouch for, with the present one, by which, *at an increased cost of from* $40 *to* $90, we obtain an unknown animal, of indifferent appearance and inferior build, and, not rarely, found an entire stranger to cavalry gaits—and we can decide without much reflection which is the better of the two. Can there be any question about it, or any denial of the assertion that a cavalry of 8,000 men, under a rich Government, and in a country of 12,000,000-odd horses, should be better mounted than our own now is? Much has been urged in favor of pony stock for frontier service. The opinion of most cavalry officers of the widest experience in this Service is that its claimed superiority to the American article is unfounded. Many of us who have scouted in a rugged, mountainous country—in which this superiority, if it exists, would be made more apparent than under other circumstances—have seen the American animal kill his one and two ponies in a summer. For all service off the frontier the latter are evidently valueless from any standpoint.

What we want, then, for the cavalry is a really good type of American horse, and I believe that the method of producing him which I have briefly sketched above is a cheap, practical and satisfactory one.

PRACTICAL INSTRUCTIONS IN MINOR TACTICS.

By FIRST LIEUT. JOHN P. WISSER, U. S. A.,

First Artillery.

WAR is a political act by means of which a sovereign State attempts to compel another State to meet its wishes. Its direct object is the annihilation of the enemy's forces which can only be brought about by *the battle*, in which the military forces of the two States try their strength. All those measures which relate to the grand field of operations, the direction of the troops toward the battle-field and the measures taken to reap the rewards of success pertain to *Strategy*. The movements on the battle-field and in its immediate vicinity, the methods for securing the safety and preserving the active power of the army, on the march, in camp and in battle, pertain to *Minor Tactics*.

The changes in tactics have gradually limited the field of action of strategy and increased that of minor tactics. The line of demarcation cannot be drawn as the two subjects are intimately connected, so that a movement, considered as part of a general plan, may be simply tactical, whereas, considered by itself, it may be strategical.

Drill Tactics have for their object the physical development of the men, their training to obey and execute commands and their exercise in movements which find application in war. The later drill tactics of Europe encroach on the province of Minor Tactics and again there is no clear line of demarcation. The tendency has been to abolish all movements and exercises which find no application on the march or the field of battle.

What we call "Tactics" no other nation in the world dignifies with that name. They are probably "Drill Tactics." What

the Germans and French call "Tactics" are really "Minor Tactics." The subject of Minor Tactics is practically a new branch of the Art of War which was formerly included in strategy and called "minor operations of war," although that subject also included much not now included under Minor Tactics, and the latter has taken some parts from the Drill Tactics.

That army which is most thoroughly instructed in the Art of War is the strongest, numbers being equal, or even differing considerably. The Franco-Prussian War is a brilliant illustration. The means of instruction may be divided into three branches—

Strategy, which only the general officers need be familiar with.

Minor Tactics, which every officer should be thoroughly instructed in; and

Military Geography, which is essential to the study of both the other subjects.

MINOR TACTICS.

The importance of the study of Minor Tactics as a factor in the Art of War is evident. The changes in the tactics of the last few years have had a marked effect on the Art of War. Strategy has become in a measure a *political* act, and the movements of a battalion, even of a company, have become *minor operations of war*. This important fact is not thoroughly appreciated in our country, and hence the great necessity for the study of this subject is only felt by a few of our officers.

The older officers of the line sometimes give the younger officers the impression that there is no use trying to learn Minor Tactics in time of peace—the only proper school is the battlefield. No doubt that is the best school, but we cannot have the benefit of that school, and when a war comes our Country does not want experiments, she wants deeds. Her little army that she pays so freely for, in spite of all her short-comings, that she loves so well, in spite of all the abuses we often get, she *expects* to be a model on which to build her grand war army. Now, all the *principles* of Minor Tactics can be learned in time of peace quite as well as in time of war. Of course, there are influences at work in time of war which cannot be brought to bear on any problem in Minor Tactics, such, for instance, as *moral effect*, but this has nothing to do with the true principles of action. With moral effect on your side you may violate principles at times, but this leaves the prin-

ciples themselves unaltered. These are as fixed and unchangeable as the principles of any other science.

The armies of this country were never opposed at the outset to an army already thoroughly instructed. All honor to those who fought so well in our Civil War, who built an army that had never its equal out of the people of the land, an army which had been taught the Art of War by experience in the field; but the army of the South grew as that of the North grew, in knowledge and experience. In the future we must be prepared to meet armies thoroughly instructed in all that pertains to War. To-day France, Germany, Austria, Italy and Russia have each from one to three millions of *trained soldiers ready for war*.

Our country has adopted the principle, in all things pertaining to her war power, to observe the measures adopted by the European armies, to profit by their experience, and to select such results as seem best adapted for our army. This is economical and rational, and the best means of attaining the objects sought are to have military attachés at the principal foreign legations and to encourage officers to go abroad to study the foreign armies.

In order to facilitate the study of Minor Tactics our Drill Tactics should be rewritten. General Upton himself felt this, and his manuscript with this object in view has been left in capable hands. But before this is done our Army should have a proper military organization. Nearly all the armies of Europe are agreed on the three battalion formation of the infantry as the only one proper for modern war, and our infantry should have it, not as a matter of promotion, but simply as a matter of organization—a step nearer reality in time of war.

The officers of the European armies are thoroughly instructed in Minor Tactics and Military Geography. The instruction begins in the Cadet Schools and Military Academies, continues through the schools of application for officers, and at every post and garrison practical problems are solved throughout the year involving the principles of both these important subjects. Even in the English Army these problems are the basis of the examinations for promotion.

The study of these subjects is not limited to the officers; the non-commissioned officers, yes, even the privates are instructed therein. During maneuvers, when a patrol comes in from an advanced position, each man is questioned as to the character of the country in the vicinity of the outpost, the direction of the

roads, the points of importance in the landscape, what he would do under various circumstances.

Colonel Lazelle was deeply impressed with the importance attached to this subject in India, and to me, in my visits to the military schools of Europe and my attendance at the French Maneuvers in 1884, it was a grand revelation to see the nations teaching what I often felt I ought to know yet saw no way of learning—*what* to do under all the various circumstances arising in war and *how* to do it, promptly and properly.

How many of our officers are familiar with even the most elementary part of Minor Tactics? I refer, of course, more particularly to those who did not serve in the War. What young officers of Artillery are capable now, without consulting books, of constructing proper field intrenchments for a battery of artillery? I have asked some of the brightest and best officers of all arms what they know of Minor Tactics, the proper way of handling a battalion on the line of battle, of conducting a reconnoissance with cavalry, of occupying a position with a mixed command, and I have yet to meet the officer who felt that he was thoroughly familiar with even the simplest duties. Nor will I acknowledge that even those who served in the War are, as a result, of that experience, instructed in the *modern* system of Minor Tactics. This is not a deep subject that requires a knowledge of mathematics to fathom it, or a knowledge of chemistry or of engineering or any specialty, it is something that pertains directly to our profession, something every officer can readily learn, something that we should all know, for it is the A, B, C, of the Art of War, the very essence of our profession.

The study of Minor Tactics may be divided into three branches:

Theory.
Military History.
Practice.

The first includes the elementary tactics of the three arms, the tactics of the three arms combined and the applications to reconnoissance, outposts, marches, bivouacs and cantonments. It discusses the principles involved and the methods employed.

The second presents the manner in which the theory has been applied in actual war. Most works, however, furnish information only on Strategy, and little of Minor Tactics is to be learned from them.

The third is the practical application of the theoretical principles by the student himself.

General Sherman once remarked, I am told, after hearing a paper on one of his campaigns read by a member of the graduating class of the Artillery School, that the officer "could criticise his campaigns but could not move a battalion properly, in the presence of the enemy, from Fort Monroe to Newport News."

The study of *military history* is carried to excess and the *practice* is either totally neglected or greatly undervalued. Our officers are generally self-reliant and have a great fund of mother wit, and, as Captain Greene, lately of the Engineers, observed to me, they readily adapt themselves to new situations, although not so thoroughly instructed in Minor Tactics, whereas the officers of the Continental armies, although they know well what they have been taught are in comparison deficient in this respect. The experience of our officers on the Plains, too, furnishes them with a great stock of useful and practical knowledge. But the study of Minor Tactics and its practice are nevertheless essential in order that we may be prepared for war so far as this is possible in our army in time of peace. We owe this not only to ourselves but to our Country. When the time comes to test our knowledge the fact that we had no encouragement to perfect ourselves in the study and practice of Minor Tactics will be no excuse for our ignorance.

Although the revision of the tactics and the organization of the infantry into three battalions to a regiment are important and essential preliminaries to the study and practice of Minor Tactics *according to our tactics*, they are not essential, if we simply assume these changes to have been made, to the method of study here proposed.

I think most officers in reading military history have been impressed with the small amount of information that they really make their own. I remember spending a large part of a year in studying the campaign in Italy in 1859, and what I principally remember about it now is that the Austrians never seemed to know where the French were! A little *practice*, however, in *applying* knowledge and principles will fix both, and that is the main recommendation of the method to be presented here. The *practice* will also make the military history all the more interesting.

MILITARY GEOGRAPHY.

The subject of military geography has for its object the con-

sideration of the relations of the geography of a country to the operations of war. It may be divided into two branches:

1. The geographical, or descriptive part.
2. The military, or reasoning part.

The former merely considers the facts as they exist without discussing their relations to the operations of war. The second contains the author's view as to the influence of the geographical features on the movements of troops.

The descriptive part presumes the existence of maps, and these are absolutely essential to a careful study of the military geography of our country. The relation of Minor Tactics also indicates the propriety of having the surveys of our country made by the War Department, as the records should be preserved there and the proper maps furnished to the officers. Lieut. M. M. Macomb, in his essay at the Artillery School, has presented this subject clearly, and his experience on the Wheeler Surveys has enabled him to propose an excellent plan for conducting the work.

The experience that officers conducting such surveys gain would be of inestimable value in time of war. It develops their powers of observation in a remarkable degree, it teaches them to read a landscape with wonderful facility, to estimate heights and distances with great accuracy and to notice objects and marks along a trail which would enable them to act as reliable guides through the country they have traversed.

Professor Tillman became so expert during his service on the Wheeler Surveys that he could go through country alone, without a guide, where even the cavalry officers stationed in the vicinity would not think of going without such assistance.

The descriptive part subdivides the section of country considered first by means of mountain chains and streams, elevations being given in absolute measure, so as to indicate climate as well as relative heights. The geology, climate and general botany of the country furnish important data. The topography of the country belongs to the military part, but a general description of the systems of roads and railroads, together with the main bridges over streams, as well as the general character of the cultivated country and its subdivision by fences, walls or dams, and the population and products of the various cities and districts form a part of descriptive military geography.

The purely military part considers first whether the general character of the ground favors or impedes the free movement of

troops, distinguishes defiles, mountains, woods, deserts, streams and plateaux; and discusses theater of war, fields of operation, lines of communication, strategic points, and lines of defense.

The importance of the study and its direct relation to the subject of minor tactics is evident.

A SYSTEM OF PRACTICAL INSTRUCTION.

The relations of the subject of Minor Tactics have been indicated and its importance has been discussed. We will now consider our subject proper and proceed to outline a system of practical instruction adapted to the National Guard as well as to the Regular Army.

This system is essentially practical, it is unlimited in its application and approaches reality as closely as is possible in time of peace. It consists in adopting the general position of the troops in an actual campaign, or assuming such a position, and selecting some special duty to be performed by the officer to whom the problem is dictated.

Lectures.—The practical work should be preceded by short lectures on the principles of Minor Tactics and the elements of Military Geography, devoting special attention to the particular points which are liable to find application in the problems. A series of lectures may, for example, be devoted to the discussion of an actual campaign, and the problems may then be derived from the events of this campaign.

The problems hereafter explained may be used in the camps of instruction or the armories of the National Guards and at the posts of the Regular Army. The commanding officer can either deliver the necessary lectures himself or detail some officer to deliver them.

These lectures should never last more than three-quarters of an hour and should be limited to the important general principles, with a few short and graphic illustrations.

The Field of Operations.—The problems may be solved in two entirely different ways: in the field or in the lecture hall.

In summer or in fair weather the problems are solved in the field, during reconnoissances (which should be made in the vicinity of every post), or during marches or rides of instruction. The field selected is usually the vicinity of the garrison or some historic battle-field. In this way the officers get familiar with the surrounding country in an interesting way, learn the elements of

military geography and apply the principles of minor tactics in a manner quite as absolutely practical as actual campaigning.

In winter or in inclement weather the problems are dictated and solved in the lecture hall, the field selected being usually some campaign.

Dictation.—The problem is dictated by the commanding officer to the company officers assembled in the field or in the lecture hall. Each officer is provided with a map. The maps published by the Engineer Department, relating to the battle-fields of the late War, are already at most posts or can be obtained by application to the War Department. Others can readily be prepared by foot or mounted reconnoissances in the vicinity of the camp or garrison.

In the solution of problems in the field the problem is dictated at that point where the officer is supposed to have been when he received his orders. After dictation the officers are allowed a few minutes to orient themselves on the maps. The situation must be probable and clearly given, the troops should correspond to the ground, and the duty to be performed and the problem should be *simple* and stated in the regular form of an order.

The information should be limited to that liable to be obtained in actual service, and the subject-matter should include only the performance of a single special duty. The problem should be solved at once in the presence of the officer dictating it.

It is clear that this method corresponds closely to what would take place in actual war. When an officer receives his orders on the field he has no other guide besides his view of the country and the maps he may possess. Time is an important element in war, therefore he should be able to come to a decision rapidly and execute his movements promptly. A *fair* solution planned and executed in half an hour is better than the best possible if it require too much time.

In the solution of problems in the lecture hall the same principles apply, although the problems are not considered in such detail as those solved in the field. This method also corresponds to reality, for often an officer receives his orders at a distance from the actual field of action with nothing but a map to guide him, and is required to make his dispositions before reaching the field or before he can see it.

Solution.—The principal points to be considered in the solution are:

1. The military estimation of the ground. This is accomplished by reading the map and interpretating its main features with reference to the problem.

2. The statement of the leading thought in the execution. This is the selection of the plan of action, determined by the general situation and the special orders received.

3. The disposition of the troops and the orders issued. This is the embodiment of the leading thought, or the measures taken to execute the plan of action.

The first step is to inform the subordinate commanders of the general situation of the troops, stating what is known about the enemy, giving an outline of the plan of action proposed and enumerating such additional facts regarding obstacles, poor communications, water supply, etc., as may be deemed of importance.

The next step is to give the necessary orders for carrying out the plan adopted. These should be brief, and contain only such general instructions as are necessary, avoiding any detailed directions unless of great importance, and they are then best given in the form of advice. The instructions should limit each commander to his proper sphere, explain to him the special object of his movement, inform him of the troops on either side of him, and indicate whence he may expect support.

4. Graphic representation of the situation at certain moments. This accustoms the officers to the relations of space and time. The tracings of the positions of the troops at various moments are made on tracing paper by first obtaining a few points of reference on the map and then sketching in the bodies of troops to the same scale as the map. It teaches officers the space occupied by troops in the various formations and enables them to calculate quickly the shortest distance to any point of a line or column and the time required to communicate with any portion.

The time allowed for the solution of the ordinary problems is from 1 to 2 hours. The solution of the problems in the lecture hall may be written. These are then criticised by the commanding officer and returned to the student.

A little consideration will convince you that this method is eminently practical. When an officer receives orders in the field to execute a certain duty there are generally a few correct ways of doing what he is required to do. There are other duties to be

performed in war besides *fighting*, and these other duties involve more real principles, as a rule, than the fighting itself. When an officer is ordered to make a forced reconnoissance he knows no more of the enemy's doing than he does in these problems, and his execution should be such as to leave him best prepared to meet the enemy *no matter what the enemy does*. But, aside from this, there is no limit to the suppositions you may make on the enemy's action and movements, therefore, the method is not open to the objection that we are considering the enemy as inactive.

The method may be made still more practical by taking troops and actually executing the movements.

The method relates to the duties of officers of all grades, and does not teach 2d Lieutenants the duties of Major Generals but teaches them their own proper duties.

To-day the subaltern officer's ordinary military duty consists in marching in the line of file-closers or attending roll-calls. These duties are necessary, of course, but when they constitute the sum total of fifteen or twenty years of service it is certainly discouraging to the subaltern and must be detrimental to proper mental growth. Many officers are interested in subjects not connected with their profession, because active minds will find a field in spite of all restrictions, and there is nothing to be interested in *in* the profession. But here is a subject, which if properly introduced and carefully taught will furnish a field for the army in time of peace beyond all calculation, and inspire us all to study the foreign tactics, yes, and improve upon them when the time comes to apply our knowledge, and add an interest to ordinary duty which it appears to me the line of the army needs almost as much as more rapid promotion.

This subject has become one of such paramount importance that its study should no longer be left to the officers as a matter of choice, but should be compulsory, as the drill tactics is now, for it is of infinitely grander scope and greater importance practically, however necessary the latter may be as well. A proper text-book should be written at once under the authority of the War Department, or Clery's "Minor Tactics," perhaps the best work in the English language, should be adopted, although in my opinion Clery includes much that properly belongs to strategy, and a more elementary work would be much more useful in our Army.

The system of practical instruction can then be carried into

effect at once at all posts, large and small, and can be made a subject for inspection by the inspecting officers just as much as drill is now. I do not wish to be understood, however, as advocating any the less drill. By no means. But drill should be combined with minor tactics to give it a practical meaning.

EXAMPLES.

We will now proceed to illustrate the method proposed by three examples.

I.

The first problem involves only the simplest principles of the elementary tactics of infantry. The commanding officer of a post in the vicinity of Franklin, Tennessee, delivers, say on Monday, a lecture lasting three-quarters of an hour on the proper formations of the battalion in the line of battle, the material for which may be found in Clery's "Minor Tactics" (p. 128 to p. 131), or in Waldstätten's "Die Taktik," Meckel's "Elemente der Tactic," or in the French tactics, "Les Manœuvres de l'Infanterie."

He also delivers, say on Tuesday, a lecture on military geography, including *first*, the purely geographical features of the country about Franklin, natural and artificial, such as elevations and depressions, water-courses, forests, roads, bridges, fords, cultivated and open ground, walls, fences and villages; *secondly*, the military relations for maneuvering troops, such as the influence of open and wooded country, slopes, road defiles and streams, and the selection of lines of position and lines of advance.

He then takes his officers, say on Wednesday, to the point of intersection of Main Street with the Columbia Pike, and dictates the following problem, which the officers write in their note-books. He then allows them ten minutes to orient* themselves on the maps with which they are provided. Each officer, in turn, is then asked what dispositions he would make at each separate distance from the enemy. The commandant corrects or approves, and sums up the result reached. The officers proceed to each new position as the problem advances. The entire solution will not require an hour.

Situation. The enemy occupies the heights to the south-east of Franklin.

To attack this position the main body of our infantry is stationed along the southern border of Franklin—the artillery

* *French*, orienter. *German*, orientiren.

combat is over—the 3d Battalion is stationed, deployed in line, its right resting on Main street.

Problem. At 11 A. M. the entire line of infantry is ordered to advance to the attack; the 3d Battalion being directed on Dr. Bergin's. Its zone of action is limited on the right by Main street and extending to the left some 450 paces.

Subject-matter of the Solution. The execution of the advance and attack up to 400 paces from the enemy's line.

Tracings of the formations of the Battalion at 1100,[x] 800,[x] 650,[x] and 450.[x]

Solution. The Battalion is stationed in the outskirts of Franklin, under cover, at 1400 paces from the enemy.

The ground in front is completely under the fire of the attacking parties.

All deep formations will increase my losses.

I conclude, therefore, to apply my forces with the broadest front and the least depth.

In order to economize the fire in each company, and to gradually increase its effect, I will begin the advance with three companies deployed in line, the left company remaining in reserve.

The development up to 400[x] from the enemy—where a gentle reverse slope to the north affords cover from direct fire—is as follows:

1. The three companies gain ground to the front, deployed in line, without a firing line—by successive bounds of about 100[x] each—up to 1200 paces distance.

The reserve company supports the advance by volleys; the elevation of its position permitting this.

2. At 1200 paces each company deploys a section as firing line, and gains, without the advance of sections of support, three successive bounds of about 100 paces each.

The firing line is now at 700 paces from the enemy.

3. The enemy's fire is becoming very effective, and the movement requires an impulse to the front.

A section of the center company, deployed in line, following the firing line as a reserve, breaks through the latter and rushes another 100[x] to the front.

Both wings support the advance by their fire and join in the attack when the subdivisions of the first advance reach the line of fire.

The firing line is at 600 paces.

4. The increased effect of the enemy's fire necessitates more substantial assistance, hence one section from each of the flank companies is applied to strengthen the line and to aid the advance.

The firing line is at 500.[x]

5. The advance becomes slow and wavering, and the firing line requires at various points an element of impulse; in each company, therefore, a subdivision is designated to break through the line and gain the cover of the reverse slope south of the creek.

The attack is temporarily suspended at this point; the resting sections retire 20 paces behind the firing line—the Reserve, which, after passing the point 700 paces from the enemy, gradually diminishes its distance from the line, closes, in company front, to 30 paces behind the left wing.

The firing line is at 400[x] distance.

II.

The second problem is intended to illustrate the method applicable in *rides of instruction*. It involves the principles of reconnoissance with cavalry. The commanding officer of a cavalry post in the vicinity of Cassville, Georgia, has delivered a few lectures on forced reconnoissances and the military geography of the country about Cassville.

Situation.—The following situation of the troops is assumed:

The 1st Brigade of the 20th Corps has occupied Cassville and the heights to the east. The 3d and 4th squadrons of the 9th Cavalry are attached thereto.

The 2d Brigade is encamped to the east of Branson's Mill.

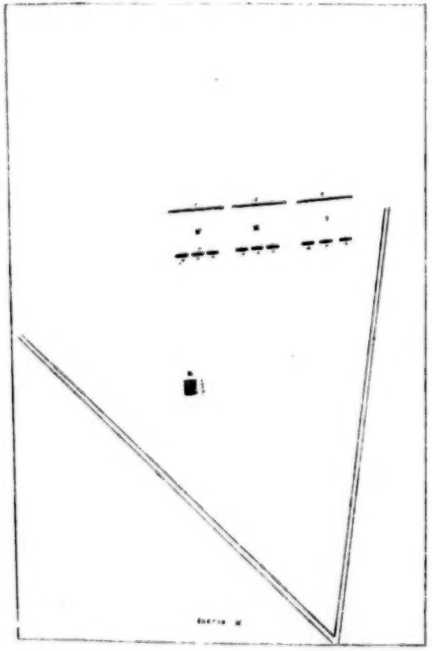
The 3d Brigade on the heights near Cass Station.

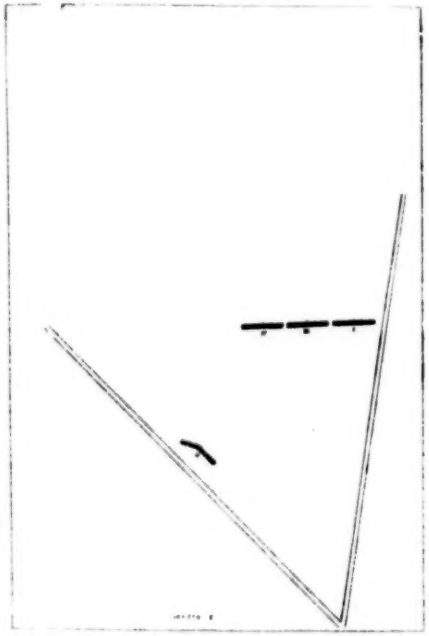
The 4th Brigade and the corps-artillery reserve at New Hope Church.

The 2d regiment of cavalry (3 squadrons) to the west of the road Cassville-Salacoa, near Drake's.

Corps headquarters at New Hope Church.

At 5 A. M., on a clear day, Colonel S. rides out with his officers on the road Cassville-Salacoa, to the place where the 2d regiment of Cavalry was encamped in the forks of the roads Cassville-Salacoa and Cassville-Branson's Mill—the 2d squadron was detached. Each officer has an orderly with him. Colonel S. orders





The firing line is at 600 paces.

4. The increased effect of the enemy's fire necessitates more substantial assistance, hence one section from each of the flank companies is applied to strengthen the line and to aid the advance.

The firing line is at 500.

5. The advance becomes slow and wavering, and the firing line requires at various points an element of impulse; in each company, therefore, a subdivision is designated to break through the line and gain the cover of the reverse slope south of the creek.

The attack is temporarily suspended at this point; the resting sections retire 20 paces behind the firing line—the Reserve, which, after passing the point 700 paces from the enemy, gradually diminishes its distance from the line, closes, in company front, to 30 paces behind the left wing.

The firing line is at 200 distance.

II.

The second problem is intended to illustrate the method applicable in *Reconnoissance and Instruction*. It involves the principles of reconnoissance by cavalry. The commanding officer of a cavalry post in the vicinity of Cassville, Georgia, has delivered a few lectures on forced reconnoissances and the military geography of the country about Cassville.

Situation.—The following situation of the troops is assumed:

The 1st Brigade of the 20th Corps has occupied Cassville and the heights to the east. The 3d and 4th squadrons of the 9th Cavalry are attached thereto.

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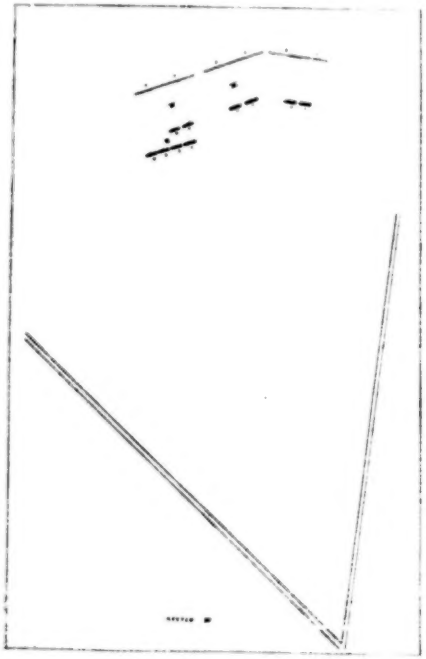
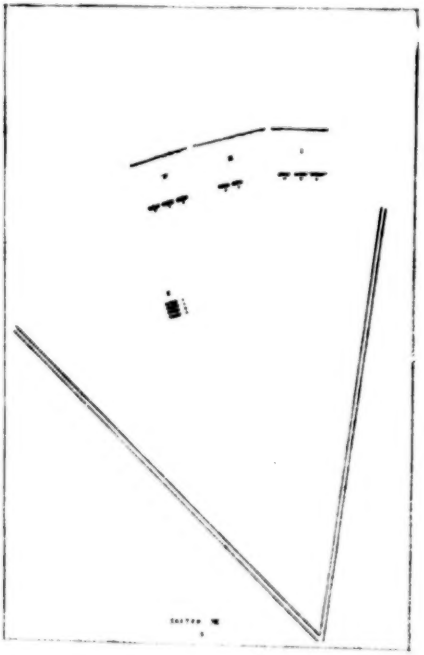
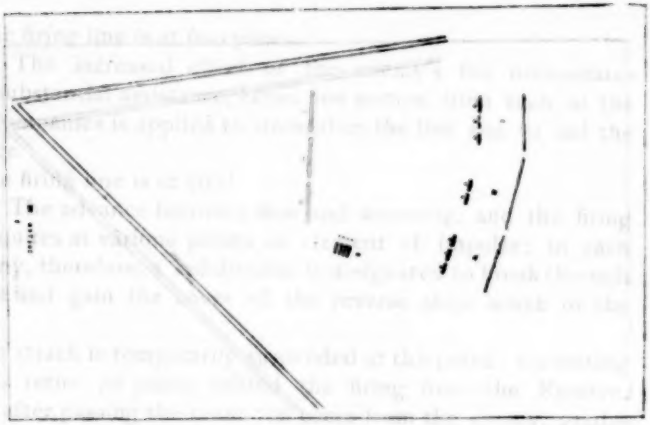
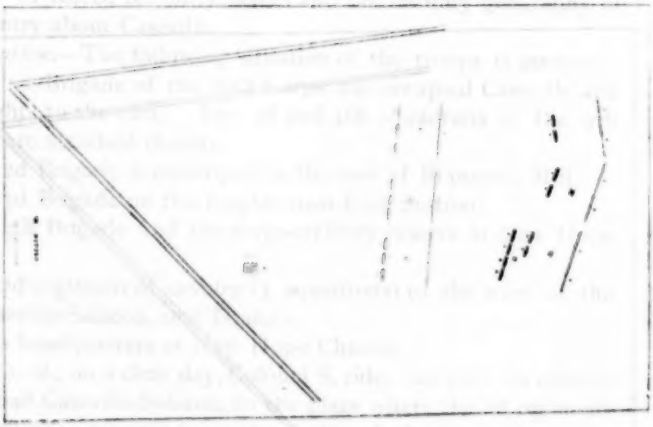
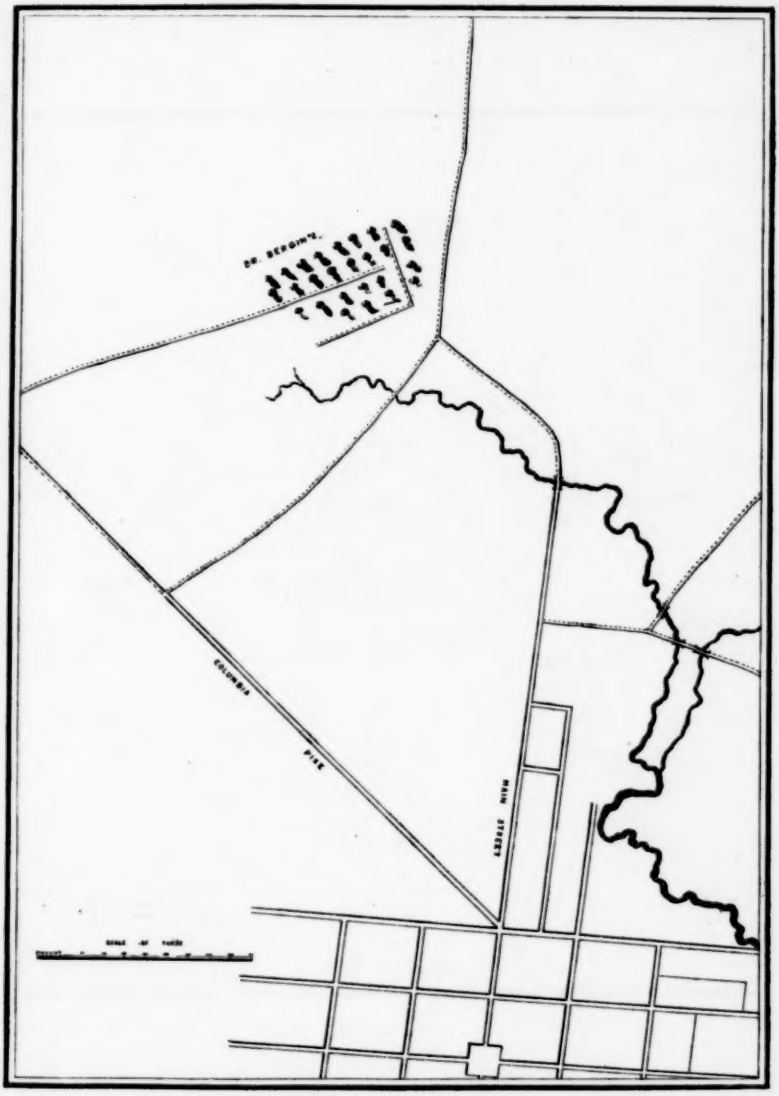


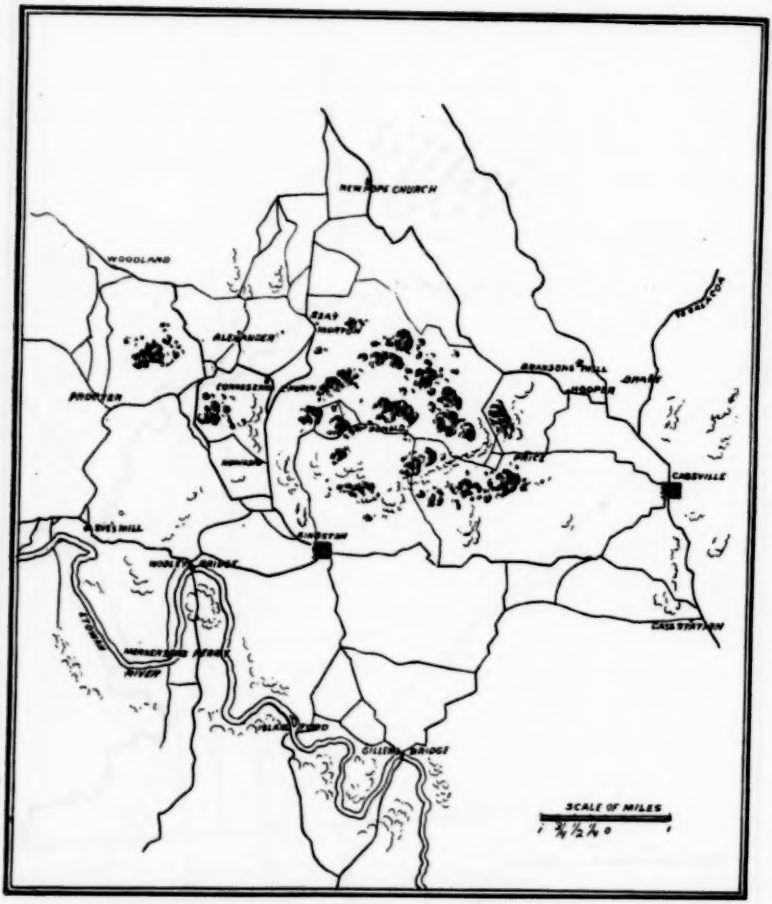








DIAG. I.—FRANKLIN.



DIAG. II.—CASSVILLE, GA.

the officers to dismount, collects them about him, and dictates to them as follows:

"We belong to the 2d Cavalry. It is 2 A. M.

"I am just leaving corps headquarters, where the commanding general gave me the following orders:

"'There is no longer any doubt but that the head of Hardee's Corps arrived at Kingston last evening.

"'Reports agree that Hood's Corps is at present *hors de combat* and cannot immediately re-appear in sight of Cassville.

"'At 4 o'clock I shall cause the corps to break camp, the 4th Brigade first, and order it to march toward Connesenna Church against Hardee's Corps.

"'To mask the entire movement and to clear up the ground to the Etowah, you will send forward at 3 A. M. two squadrons, along both sides of the road from Howard's to Kingston, under the command of Lieutenant-Colonel G.

"'The Lieutenant-Colonel will direct his dispatches to the headquarters of the 4th Brigade, which will march from New Hope Church at 4 o'clock, and take up its first position on the plateau south-west of Connesenna Church, on both sides of the road Woodland-Howard's.

"'A third squadron will march with the 4th Brigade, the 4th and 5th squadrons will remain with the 2d Brigade, which will break camp at 3:30, and march up past Alexander's, south-east of Woodland.

"'The 1st Brigade will remain at Cassville with 2½ squadrons to observe the roads leading in the direction of Hood's Corps.

"'The 3d Brigade will leave a platoon of the 9th Cavalry to observe the passages of the Etowah at Island Ford and Gillems.'

"The officers will write this order in their note-books."

After an interval of ten minutes Colonel S. proceeds:

"Gentlemen, put yourselves in the place of the commandant of the two squadrons ordered to reconnoiter toward Kingston.

"It is 2 A. M., in camp all is quiet, the horses have not yet been fed, at 3 o'clock you must break camp. What must take place before 3 o'clock?"

After several minutes' pause, Colonel S. requires one of the officers to answer—he will state accurately what takes place with reference to ordinary duty and food and fodder.

In case he forgets to mention some point, or commits an error, Colonel S. asks another officer to correct him, to impress on

the officers the fact that *together* they know the entire subject, thus encouraging discussion among them.

Colonel S. then proceeds:

"Gentlemen, look at the map—what kind of ground are we to operate on; what relation does it bear to the problem before us?

"You are allowed ten minutes to think the matter over."

At the expiration of this time one of the officers is asked to state his answer, then another, and so on.

Each will probably bring out some important point. After all have spoken, Colonel S. calls attention to the correct and the incorrect statements, and gives in conclusion his own answer, as thus:

"Mountainous country, largely covered with clumps of woods.

"East of the road Howard's-Kingston the view is limited. From the hill West of Karr's, and the hill above Morton's, a good look-out can be obtained.

"The slopes moderately steep, we shall be able to maneuver freely, but must be careful, as the ground favors surprises.

"To the Etowah the declivity is steep. It flows as far as Kingston in a ravine-like valley, then the heights retire somewhat and become lower but remain steep. No fords except at Island Ford.

"At Howard's there is a ravine-like valley which divides the field into two parts, the more westerly of which is most exposed to view and furnishes cavalry freedom of movement in march and battle."

Colonel S. then puts the question:

"How will you carry out your orders? You are allowed fifteen minutes' time."

After the expiration of this time one after another is required to state his answer.

Colonel S. then gives a résumé of the best parts.

"According to your answers the following is the *leading thought* deduced:

"We must advance rapidly and with a broad front. When we arrive on the Etowah we will take position at the bridge and ford there.

"Many clumps of woods and rolling country—hence precautions against surprise, and I cannot personally conduct all the parts.

"We will be least liable to meet the enemy's outposts in the section east of Howard's, more probably in that to the west, but most probably in the defile itself.

"But the advance in the defile will be checked when threatened from the heights above, hence a strong patrol will be sufficient in the defile. The subdivisions will find greater freedom of motion and action on the crests.

"The two squadrons I will divide into two groups. A ½ squadron I assign to the main road and the section east of it, and commit to it the duty to establish communication with Island Ford. It will ride over McDonald's.

"With 1½ squadrons I will move over Hall's-Connesenna Church into the western section, and proceed with flankers over Proctor's to Eve's Mill.

"My road is somewhat longer though better than that of the ½ troop, so that I shall be better able to take a steady trot. But the ½ troop, after arriving east of Howard's, will not advance until I have passed Howard's on the west and arrive nearly on a line with it.

"We can be on the Etowah by 4.30, and will then have a point of support in the 4th Brigade, the head of which will have arrived at this time on the height north of Howard's, and we can then count on the troop of our regiment which was ordered to march with the brigade."

These are the considerations from which the orders to be issued will result.

The problem may be solved in several different ways, *e. g.*, to ride with both squadrons over Hall's to Connesenna Church, or over McDonald's, and there divide the command. But there is rarely time, and it is unnecessary to worry about attaining the *best* method—the more plans are considered the more uncertain one becomes. A *fair* solution well executed will be quite sufficient.

"We have now decided *what* is to be done, and the question remains, *how* is it to be done?

"Gentlemen, you will write on a sheet of paper the orders which you, as commandant of the two troops, would give in presence of the assembled officers. Fifteen minutes will be allowed."

The orders are read and discussed. The accepted order will read:

"We will divide into two groups.

"I will operate with the 1st and one-half of the 3d squadron over Hall's and Connesenna Church in the section west of Howard's, between Proctor's and Howard's; the other half of the 3d squadron, under Captain W., in the section between Howard's and Island Ford, including Kingston.

"Captain W., you will ride over Price's and McDonald's toward Howard's and then turn to the left; you will keep the main body of your command on the crest east of the highway until you arrive in the vicinity of Kingston, and keep a patrol in advance on the highway, which will be flanked on the heights west of the road by several horsemen with a view to establishing communication with me.

"You will establish communication from McDonald's with the 9th Cavalry at Island Ford.

"If you succeed in reaching Kingston, you will secure it at once. I will ride with my column over Hall's and Connesenna Church. When you arrive on the height east of Howard's, in case I have not yet arrived on the heights opposite you, halt there with the main body of your command until I am in line with you.

"Captain D., send an officer and three men at once over New Hope Church, he will wait for us at Morton's on the road to Connesenna Church, and meanwhile observe the ground in the direction of Kingston.

"He will probably meet an outpost of the 4th Brigade at Morton's.

"On the way there he will report to the brigade commander and notify him of our march."

These are all the orders necessary before marching. The Colonel himself rides with the 1½ squadrons, and further dispositions affecting this column will not be necessary until it has passed the outposts of the 4th Brigade. Until then the column is closed.

Colonel S. then gives Captain D. the following directions:

"Captain, you are commandant of the 1½ squadrons and will ride with Lieutenants Sc., McC., R. and A. over New Hope Church-Connesenna Church, into the section assigned to this command and discuss with the officers during the march the manner in which the column will march, where and how, how it will protect itself, how keep up the communication.

"Carry out the work as rapidly as possible, and mark the prin-

cipal patrols by officers (*e. g.*, those over Proctor's) who will ride exactly where the patrols are to ride.

"One of the officers will go to Wooley's Bridge, to Merkerson's Ferry and to Eve's Mill.

"After passing ½ hour in the valley you will assemble at the cross-roads Kingston-Woodland and Howard's-Proctor's.

"I will be there with the other officers at 9 o'clock."

After comparing watches Captain D. rides off with officers designated.

The rest—Captain W. and Lieutenants Q. P., K., H. and F.—are directed to dismount, and Colonel S. orders:

"Mr. Q. P., you will represent my middle patrol. We will move at a walk for a while, do you go at a trot over Price's and McDonald's and wait for us at the cross-roads on the height west of McDonald's."

Later, as we are passing Hooper's, Colonel S. orders K.:

"Ride through the valley between Price's and Hall's to the crest of the hill of Seay's, remain there until you see the detachment of Captain D., then ride to the height east of Howard's to hunt me up. I will go there from McDonald's."

At McDonald's Colonel S. orders H.:

"Ride direct to Island Ford to inform the 9th Cavalry of our advance.

"Await further orders at the Ford."

After finding A. P. at the cross-roads, and being informed by him that at 7.30 the detachment of Captain D. approached Morton's, Colonel S. halts at a point about half-way to Howard's, furnishing no outlook, causes the maps to be examined, and asks: "Where are we now?"

As soon as A. P. and F. have found the place Colonel S. dismounts and writes the following order:

"Between McDonald's and Howard's at 7.45 A. M.

"Sent by Lieutenant F.

"Lieutenant H., you will advance with your detachment direct to the cross-roads Kingston-Woodland and Howard's-Proctor's. At 9 o'clock you must be there with F."

Colonel S. orders F.: "Ride with this order direct to Island Ford"—and rides on.

When all have assembled at the rendezvous and have dismounted Colonel S. puts the question:

"Mr. Sc., you went to Eve's Mill; what did you see there?"

He is allowed to relate. The others are questioned in the same way. Colonel S. then dictates the following, which is copied in the note-books:

"You are commandant of the two squadrons. At 8.30 o'clock a staff officer of the 4th Brigade comes up and addresses you, saying:

"'I am directed by the General to inquire of you as to the appearances of the Etowah valley between Island Ford and Eve's Mill.'"

Colonel S. proceeds:

"You have heard the report, what sort of a description will you furnish the staff officer?

"Write it on a leaf of your note-book."

When completed, the leaves are torn out and handed to Colonel S.*

Colonel S. orders the officers to mount, and rides with them to Wooley's Bridge, halts there, and makes the following supposition:

"You are sent by Captain D. to this place to secure possession of the bridge until the advance posts of the infantry of the 4th Brigade arrive.

"The ½ squadron of Captain W. has gone to Kingston, and is occupied there.

"Just as you reach the bridge several hostile horsemen become visible on the heights behind the opposite shore.

"What will you do?"

The first question that arises is, Will you proceed over the bridge? At present it will not be safe. But the enemy, and first of all his cavalry, must be prevented from crossing.

The next point for consideration is, Will you defend the bridge by small-arm fire simply? Would this be applicable? How would you take up your position, since the ground near the bridge is commanded from the opposite bank? Where would you put your horses? Where the skirmishers?

There is no time to attempt the destruction of the bridge. A barricade may be constructed if there is a country wagon in the vicinity, or with harrows or plows from the fields, or vegetables or hay may be carried from the stacks in the fields to the bridge, and if the hostile detachments make demonstrations and threaten to advance, set it on fire.

* These will serve as points for consideration in a lecture on the problem.

Colonel S. requires the officers now to write the dispatch which they would send to the 4th Brigade. It should read thus:

"Heights west of Kingston.
"4.30–28–2.

"Reached Etowah without incident—hostile horsemen appear at this moment on the opposite bank. I order the bridge to be occupied."

This closes the ride of instruction. Colonel S. rides wth his officers to Kingston, and, after a sufficient rest, trots back to the post over Gillems and Cass Station.

This sketch will be sufficient to indicate how this method of instruction may be conducted and made useful and interesting.

III.

The third problem involves the applied tactics of the three arms combined. The minor tactics of artillery is almost entirely limited to the battle-field; on the march or in camp the main question is one of protection and not of action, still a great many questions relating to the care of the artillery on the march and in camp might be involved in these problems. Its active sphere, however, is the battle-field, and here the main questions are as to position in the line, as to mode of action, as to the proper time to begin and to stop firing, and as to the successive positions taken up during the different stages of the battle and the objects to be fired at.

The scene of the problem before us is in the vicinity of Richmond, Virginia. The Commanding Officer of a post there delivers one or two lectures on the elementary tactics of the three arms, the duties of advance guards and the occupation of positions for defense, together with a lecture on the military geography of the country about Richmond.

He then takes his officers to the north-west corner of Manchester, on the hill of Redoubt No. 13, and dictates the following problem, which is solved on the same general principle as those already described. The officers should be mounted for the solution of this problem in the field. This problem may also be solved in the lecture-hall by means of the general map of the "Region between Gettysburg and Appomattox Court House, Va.," and the special map of "Richmond."

Situation. The army is marching from the south toward Richmond, in order to cross the James River at this point. To-day at 9 A. M. the 1st and 2d Infantry Divisions will cross the river for the purpose of occupying the ground in front of the

defile at the Westham Iron Works, to and including P. Warring's together with the fronts of support Redoubts Nos. 10, 8, 7, and 6 (which are here supposed to be elevated positions and not fortifications), in order to cover in this position the passage of the army over the stream.

Problem. The enemy, whose cavalry entered the line of the upper Chickahominy near the Springfield Coal Pits* (see general map) yesterday afternoon, is to be brought to a stand as far as possible from the position selected in order that the necessary measures for defense may be carried out.

The 1st Infantry Division sends for this purpose a detachment under your command, consisting of the 2d and 3d Battalions of the 14th Infantry, 1-2 Regiment (4th, 5th and 6th Squadrons) of the 1st Cavalry, and 1-2 Battery (3 in. rifles), 1st Artillery, with the following orders:

"Move at once over the bridge of the Richmond and Fredericksburg Railroad on the Deep Run Turnpike toward the South Anna River as far as Blair's, where a position suitable for a continued resistance will be selected. You will have the cavalry destroy the passages over Brook Run from Pruett's to and including the Richmond and Fredericksburg Railroad. Observe this stretch and establish communication with the detachment of strength equal to your own sent out by the 2d Division from the north-east corner of Manchester over the bridge there, over hill No. 6 to E. Crouch's, and which observes and guards the line of D. Duval's to the railroad.

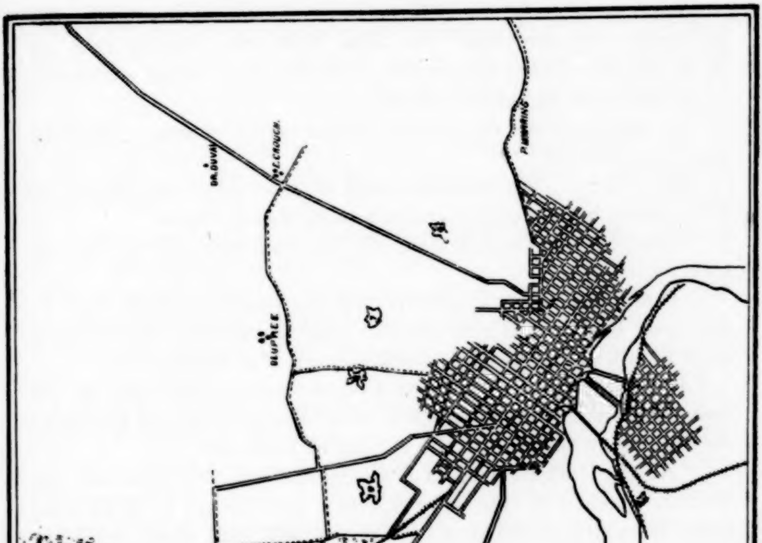
"The two battalions of infantry, arriving later, will remain in the position at Blair's, and will guard by detachments the road from B. Green's to Green's Mill, and, by assigning cavalry thereto, establish communication with our own troops posted in front of the defile at the Westham Iron Works.

"Your detachment will remain in this position till 5 P. M., at which hour you will receive further orders.

"All dispatches to the north-west corner of Richmond.

"If met by superior forces the line of retreat of your left wing will be over the road between hill No. 10 and the Westham Plank Road to hill No. 11; the line of retreat of the other parts, on the road between hill No. 9 and hill No. 10 and on the right of Deep Run turnpike to the north-west corner of Richmond.

* About 10 m. north-west from Richmond.



DIAG. III.—RICHMOND, VA.

"Continue to supply your troops to-day by requisition. Only the light field train will be taken."

Subject-matter of the Solution.—1. Assumed that your detachment, together with the light field train, stands at 8.15 A. M. on the north-west corner of Manchester facing southeast.

Wording of the orders issued.

At what hour did the cavalry set out on the march? At what hour the infantry?

Solution.—1. The commandants are assembled, and the orders which have been received are communicated to them.

Order to the commandant of the half-regiment of the 1st Cavalry:

"Cross with three squadrons over the James on the R. and F. Railroad bridge and ride on the road toward the South Anna over Blair's to Brook Run, south-west of Mrs. Lound's.

"In advancing cover the space on the west of the road in the line Hill No. 11, B. Green's (near Browning's) and Pruett's; on the east in the line of the R. and F. Railroad.

"At the fork of the road to Spotts' you will send out one section which will ride over Spotts's and Hicks's to B. Green's (near Browning's) and then to Green's Mill and there establish communication with our troops posted before the defile of the Westham Iron Works.

"To guard the road, B. Green's (near Browning's) to Green's Mill, a detachment of the 14th Infantry will follow this section.

"To the right, on the R. and F. Railroad, in the direction Deupree's-E. Crouch's, you will establish communication with the cavalry of the 2d Infantry Division.

"The bridges over Brook Run from Pruett's to and including the R. and F. Railroad will be destroyed by the cavalry pioneer section.

"After completing your work you will observe this space. In case you are attacked by superior forces and compelled to retire you will retreat eastward of the road toward the right wing of my position at Blair's. Order for requisition will follow.

"I will ride with the 1-2 regiment to Blair's, whither all reports are to be sent.

"Leave ten cavalry-men for orderly duty.

"Ride alternately at trot and walk."

Order to the ranking commandant of the two battalions of the 14th Infantry:

"I will ride on with the cavalry to Blair's and there reconnoiter the position."

"Assume command of the detachment and march over the R. and F. Railroad bridge through Richmond on the Deep Run turnpike, in secured order of march, to Blair's, where I will personally give the necessary orders for the occupation of the position.

"Four cavalry-men are assigned to you as orderlies."

Cavalry set out on the march at 8.30 A. M.; infantry at 8.40 A. M.

Subject-matter of the Solution, continued.—2. In the position at the north-west corner of Manchester.

You are commandant of the division cavalry. Action of this command in obedience to orders received from you under 1.

Solution, continued.—2. Squadron and section commandants are assembled.

Order to the commandant of the 6th Squadron:

"My orders are known to you.

"The destruction of the bridges of Brook Run, from Pruett's to and including the R. and F. Railroad you will effect by means of the Pioneer Section, and protect the working party by means of the other three sections, and after destroying the bridges you will observe this section of ground. For this purpose you will take up a central position with a half squadron behind the woods at Lipscomb's on the road, and carry on the observation of the section of ground assigned to you by means of small patrols pushed out to Brook Run. The other 1-2 squadron (Pioneer Section) you will send to join the main body of the cavalry, which will probably be stationed at Elliott's.

"I will personally assure myself of the destruction of the bridges. Let the advance patrol, 1 section strong, move off.

"Your line of march will be over the R. and F. Railroad bridge, Richmond, over the Deep Run turnpike. On reaching the north-west corner of Richmond you will send a patrol to clear up the ground on the flank over Hill No. 11, Spotts's–Hicks's to B. Green's (near Browning's), from which point it will attempt to establish communication again with its squadron at Pruett's.

"A second patrol will advance along the east of the road, between the road and the line Greenwall's–J. Sinton's–Winston's; and a third along the R. and F. Railroad.

The last-mentioned will seek to establish communication with

the cavalry of the 2d Infantry Division in the direction Deupree's–E. Crouch's.

"While you are in this position for observation at Brook Run you will preserve this communication.

"With the main body of the cavalry I will follow you as far as Elliott's where I will select for you a final position.

"Move alternately at trot and walk."

After the 6th Squadron has gained the distance of 800 paces I command:

"Fours left—trot—march (4th Squadron at the head). A patrol of the 5th Squadron as rear-guard."

During the march through Richmond and past Hill No. 10 I give the commandant of the 1st Section of the 4th Squadron the following order:

"You will turn off with your section at the cross-roads near the old line of fortifications toward Montague's and ride thence over Spots's and B. Green's to Green's Mill. There you will establish communication with our troops posted before the defile near the Westham Iron Works.

"A detachment of the 14th Infantry will follow you.

"The object of this movement is not only to establish communication as stated, but also to guard the road B. Green's-Green's Mill and the Westham Plank Road.

"You will therefore send a small patrol every hour over Ginnett's, Cater's, B. Green's (near Browning's); and another patrol in the opposite direction over the same route.

"Reports you will send to headquarters at Blair's."

With the main body of the cavalry I will go ahead on the road. Terminus of march: Elliott's.

Subject-matter of the solution, continued.—3. Arrival at Blair's.

(*a*). When did the main body of the cavalry arrive at Blair's? To what point is the advance conducted and what further orders are given?

(*b*). Assuming that the commandant of the entire detachment arrived with the cavalry at Blair's will he find it necessary to issue any orders there, and if so, what orders?

Solution continued.—3. (*a*). The main body of the cavalry arrived at Blair's at 9.35 A. M.

The march of the main body of cavalry is continued to Elliott's as decided under 2.

(*b*). Here the commandant of the detachment gives the following orders to the commandant of the cavalry:

"The three sections of the 4th Squadron will remain in rear of Blair's and will deploy in line of skirmishers on the line of the old fortifications, until the arrival of the main body of the detachment, so that, in case you come in contact with superior forces in your advance and are forced to retire, you will find a secured position ready for you which will be held till the arrival of the battalions of the 14th Infantry. Your retreat will, in this case, take place toward the right wing of the position between earth-work No. 1 and the railroad.

"If it becomes necessary for the 4th Squadron to open fire, all three sections will be placed on the line, and it will be your duty to protect them.

"Ride on with the 5th Squadron and carry out your orders.

"I will remain here."

To the commandant of the 4th Squadron:

"In anticipation of a possible retreat of the cavalry which has been sent forward, and of an attack by the enemy on the position, you will occupy the old line of earth-works with your three troops and hold yourself in readiness to open fire.

"Earth-work No. 1 on the right wing you will occupy with 1 section, No. 2 with 1 section, the point of crossing with the road with 1 patrol (about 10 men) and earth-work No. 3, west of the road, with 2 patrols.

"The protection of the cavalry in the skirmish line will be undertaken by the cavalry subdivisions which have retired.

"For the purpose of establishing communication with the cavalry section detached to guard the road B. Green's-Green's Mill, you will send a small patrol every half-hour on the road from Blair's over Spots's to B. Green's."

Subject-matter of the Solution, continued.—4. After your return to Blair's from Elliott's.

When will the two battalions of the 14th Infantry arrive at this place?

You are commandant of the entire detachment—what orders will you give to the battalions?

Solution continued.—4. The two battalions of the 14th Infantry, with the ½ Battery and the light field train, arrived at Blair's at 10.50 A. M.

After assembling the commandants of battalions and the artillery, I give the following orders:

To the commandant of the 2d Battalion:

"Send at once ½ company, under the command of the company commander, to B. Green's. The object of this movement is to secure the road B. Green's—Green's Mill, and to preserve the communication with our troops posted before the defile near the Westham Iron Works.

"The 1st section of the 4th Squadron, previously sent there will be under the command of this captain.

"In the event of a general attack and a consequent retreat, the line skirting the woods from B. Green's (near Browning's) to Spotts' is designated for this detachment, then between Hill No 10 and the Western Plank Road to Hill No. 11.

"Requisitions for food and forage will be made by this detachment in the section around B. Green's.

"Reports will be sent here.

"You will occupy for the present the earthwork No. 1, the point of crossing with the road and earthwork No. 3 with ½ company, earthwork No. 4, and the one projecting to the northwest (I point out these objects) with 1 section. The wings of the position must be secured by sending out patrols.

"You will personally direct the occupation of this line, and by means of the pioneers of both battalions of infantry you will have the old earthworks, especially the point of crossing with the road, put in condition for a stubborn defense.

"Distances are to be estimated.

"The rest of the battalion will take up a position with the 3rd battalion in rear of the line, and will be employed in making requisitions for food for the men and forage for the horses of the battalion.

"Place for requisitions for your battalion: the suburbs of Richmond, west of the Deep Run Turnpike.

"I will remain at the center of the line."

To the commandant of the 3d Battalion:

"Take up a concentrated position with your battalion, the 1½ companies of the 2d Battalion and the light field train in the woods in rear of the line of earthworks.

"You will make your requisitions for food and forage for your battalion in the suburbs of Richmond, to the east of the Deep

Run Turnpike. The subsistence necessary for the ½ Battery will also be obtained there.

"Thereupon rations will be prepared.

"Place of alarm: in your position.

"I will remain at the center of the line."

To the commandant of the 2 sections of Artillery:

"Take up a position with the ½ Battery in earthwork No. 2. Projectiles behind the earthwork. Ammunition wagons in the woods alongside of the road, and about 200 yards in rear of the line.

"The 3d Battalion will provide the necessary food and forage for the ½ Battery. Send on a non-commissioned officer with information as to what is required.

"Thereupon rations will be prepared and the horses fed."

To all the commandants:

"In the event of retreat, the left wing will retire along the left of the road, between Hill No. 10 and the Westham Plank Road to Hill No. 11; the center on the road, and the right wing on the right of the road to the northwest corner of Richmond.

To the commandant of the 4th Squadron:

"Assemble your three sections and join the main body standing at Elliott's.

"You will take with you the order to the commander of the half-regiment."

The latter is worded:

"*Sent by:* The commandant of the detachment near Blair's.

"*To:* The commander of the ½ regiment at Elliott's.

"*Dated:* Earthworks, near Blair's, February 21st, 11 A. M.

"Subsistence for men and horses is to be obtained by requisition in the section about Bethlehem Church, then rations prepared and horses fed.

"The communication toward Pruett's is to be observed.

"*Sent at:* 11.50 A. M. *By:* Private N.

"*Gait:* Trot and walk."

Then I send the following report to the commander of the Infantry Division:

"*Sent by:* Detached commander at Blair's.

"*Dated:* Blair's, February 21st, 11 A. M.

"Position in the line of the old earthwork at Blair's occupied.

"For the security of the road B. Green's—Green's Mill, half-company of Infantry and 1 section Cavalry detached.

"Communication with Westham Iron Works established there.

"Main body of Cavalry, 2¼ Squadrons, at Elliott's.

"Bridges over Brook Run destroyed.

"For the observation of the ground a half-squadron is pushed out.

"Communication to the right with the Cavalry established there.

"*Sent at:* 11.15 A. M. *By:* Corporal M.

"*Gait:* Trot and walk."

These examples will be sufficient to illustrate the proper method of instruction in Minor Tactics. Before concluding, I wish to express my gratitude to our President, General Schofield, for first inspiring me with an interest in this subject by predicting its great importance several years ago, and recommending its study to the young officers then at West Point. I would call attention, too, to the fact that Captain Green, lately of the Engineers, was the pioneer of practical instruction in minor tactics in our Army in his work with the Corps of Cadets at West Point a year or two ago.

This is a great age of progress, and the military profession can no more afford to stand still than any other scientific profession. There *is* no standing still; the moment you cease to work in these days you fall behind, and no one hesitates to go above you. The modern battle is not a matter of drill and target practice. If you fail to bring your men within good rifle range, of what use are your sharpshooters? If you do not know how to maneuver and subdivide your battalion so as to have the least number killed before the assault, of what use are your well-drilled companies?

The fire of a line of battle is utterly regardless of the quality of the material it is mowing down.

Drill and target practice are both excellent means of preparing troops for war, but they only furnish good material. The proper use of this material to the best advantage must be learned from the principles of Minor Tactics.

MOBILIZATION AND CONCENTRATION OF THE CANADIAN MILITIA FOR DEFENCE OF THE FRONTIER.*

II.

3. *Montreal.* The development of the railway system has certainly aided offensive movements against Canada more than the defensive. This would not be the case were the chief objective points situated at a great distance from the frontier. Here we find Montreal, the chief city of the Dominion, three easy days' march from the border. Based on Albany, as of old, only 200 miles from the city, a hostile force may there be assembled with great rapidity. Excellent railway communications run to this point from all parts of the States; there is a free water-way up to the head of Lake Champlain and thence by the Richelieu River to the St. Lawrence, into which it flows 45 miles below Montreal. The resources of the United States should be sufficient to place a force equal to undertaking an attack upon Montreal at Albany in a few days, provided the interval granted by diplomacy has been made use of for the necessary preparations.

The whole of the country between Albany and Montreal is well adapted to military operations.

Any defence of the city must naturally be organized on the south side of the river. If the river were once gained there can be no doubt that the operation of crossing it would immediately follow and the investment of the city be complete. If defensive works can be anywhere valuable, this is surely the place. If any opposition were offered to the advance we must look upon a decisive battle near the head of Lake Champlain as a certainty. It would then be the policy of an enemy to make his advance so rapid as to allow no time for the erection of defensive field works. The Richelieu Canal, at the head of the Lake, which gives en-

* Continued from *Journal* No. 29.

trance to the St. Lawrence; the Beauharnois Canal, 15 miles above Lachine, and on the south bank of the river, which gives a water-way for a relieving force from the west; the Victoria Bridge; the Lachine Bridge; all these are minor objective points which an enemy would attempt to seize.

In Montreal and the adjacent country there are at present troops to the number of about 7800 men.

To continue the exercise, it is proposed that, of the units which these troops represent, a corps, consisting of 3 divisions, should be formed, as shown in the "Order of Battle" herewith.

Of these three divisions, the First Division would require to be rapidly raised and concentrated, *after mobilization*, at some point on the east bank of the Richelieu River. It is composed of units which form part of the Second and Third Brigade Divisions, and consists of two complete infantry brigades, of three battalions each, with a divisional battalion, a cavalry regiment and 2 batteries of artillery, making a total of 7 battalions, 4 squadrons and 8 guns; or 7800 men.

The Second Division would require to be raised immediately, and might well be concentrated at some point on the west of the Richelieu River, commanding the direct line of advance and covering Beauharnois Canal and Lachine Bridge. It would consist of troops of the second, fourth, fifth and sixth Brigade Divisions, and would be organized as the First Division with a total strength of 7 battalions, 4 squadrons and 4 guns; or 7650 men. Strong detachments of both these divisions would be sent forward to the frontier, and a strong defensive line should be selected and prepared in the neighborhood of Chambly or St. John's.

The Third Division may be held primarily in reserve in second line. It consists of six battalions located in Montreal, with a divisional battalion, an engineer company, and two garrison batteries. Its strength is 7 battalions, one company engineers and two garrison batteries; or 7300 men.

If we now bring the Eastern Division, composed of the New Brunswick and Second Quebec Brigades toward Montreal to guard the left of the line, and if we also bring to this point the Kingston Field Division (formed as noted below), to operate on the right flank, we shall have a total force concentrated round Montreal of 5 divisions, giving 35 battalions of infantry, 17 squadrons of cavalry, and 32 guns; or 38,700 men in all.

4. *Kingston.* This city is an objective of some importance,

owing to its position as covering Ottawa, guarding the head of the St. Lawrence, and thus enabling an enemy, after its capture, to move either directly on the capital, or by a flank movement on Montreal. If this latter operation was regarded with favor in former wars, before railways and canals added facilities for movement, it might be much more decisively used now. Kingston is also a chief harbor on Lake Ontario, the command of which we should expect to keep.

It has been said that, in order to add to the numbers for the direct defence of Montreal, a force would be detached from the Kingston district to guard the right flank of the defensive line there, or to operate on the river between Kingston and Montreal wherever required.

This Division is composed of 2 brigades of infantry, the first of which is drawn from the east of Kingston, and the second from the west. The 43d battalion is taken from Ottawa as the divisional battalion, and a regiment of cavalry with the Prescott troop, and three batteries of artillery complete the Division. Its strength then is, 7 battalions, 5 squadrons and 12 guns; or 8050 men.

For the defence of Kingston against local attack a completely organized division is left. This force should be not a mere garrison, but should be capable of taking the field and opposing a hostile landing at a distance from the city. The force consists of 7 battalions, 4 squadrons and 4 guns, or 7650 men.

5. *Western Peninsula.* In the Western Peninsula there are two chief lines by which hostile attack may develop; the one by the Niagara frontier, the other by the Amherstburg district. Of these two we must look upon the former as likely to be the more decisive, owing to the fact that a success there would immediately threaten the line of retreat of any force advanced into the western angle. But no operations here are likely to be decisive of a campaign so long as Montreal and Quebec are safe. An advance in this direction must, however, be looked for and guarded against, as it would be undertaken with a view to keeping the forces of the defence in these districts.

The troops located here will furnish sufficient men for the formation of three complete divisions, and a fourth incomplete division of six battalions.

The First Division, composed entirely of troops of the First Brigade Division, with a field battery added, may be concentrated

at London. It comprises 7 battalions, 4 squadrons and 4 guns; or 7800 men.

The Second Division comprises seven battalions from the Third Brigade Division, with a regiment of cavalry and two field batteries. This is concentrated about York, with detachments pushed forward to guard the Welland Canal. The total strength is 7 battalions, 4 squadrons and 8 guns; or 7800 men.

The Third Division, concentrated at Guelph, will be held in second line, ready to be moved to either side according to the direction of the attack. The troops are provided chiefly from the second Brigade division, and number 7 battalions, 4 squadrons and 4 guns; or 7650 men.

These three divisions should be combined under one command. The fourth incomplete division of six battalions and two garrison batteries may be held primarily for the direct defence of Toronto, and be used later for re-enforcing the front, as circumstances dictate.

The total strength available in this matter will be 27 battalions of infantry, 12 squadrons, and 20 guns; or 26,450 men.

Thus, referring again to the numbers which in our opinion would be adequate for the protection of the frontier, and which were stated in the first portion of this exercise, we find that, after drawing a brigade from New Brunswick we still have a deficiency. In regard to numbers, as stated here, we have, for purposes of calculation, raised the present infantry battalions to 1000 men, cavalry regiments to 500, and batteries to 150 men, omitting all mention of staffs, services, etc.

The total available force, under this rule, appears to be 81,900 men. To this number we may add 2 per cent. for staffs, Brigade, Divisional and Corps, making the total up to 84,500. In this number there are comprised 78 battalions of infantry, 37 squadrons, 56 guns and 2 companies of engineers.

The full complement estimated as required for the defence of Quebec is nearly reached, 9100 men against 10,000. For Montreal, in place of 50,000 there are 38,700 men. For Kingston, the Division numbers 7650 men instead of 10,000; and for the Western Peninsula 26,450 in place of 50,000. The numbers so disposed leave nothing for the movable corps of 30,000 men for operation along the frontier. From 8 to 10 new divisions

would have to be formed to bring the force up to the estimate, and there is no nucleus on which to form them.

Proportions of Arms. The force is weak in artillery. The proportion is 1.4 guns to 1000 men, the usual proportion being 3 to 4 guns per 1000. The force of cavalry is also weak, being about 1 saber to 17 bayonets in place of the usual proportion of 1 in 6. Engineers are extremely scarce. We have here 1 in 400, the usual proportion in Continental armies being 1 in 30.

Permanent Schools. The schools have not been reckoned among the numbers available for defence, since the officers and men of these, being more highly trained, would be required for staff purposes, and special duties. The three artillery schools would, however, furnish guns for three additional batteries, and a fourth battery of light guns could be drawn from the Military College.

Provision of Officers. There are but 1262 qualified regimental officers in the districts under consideration; this number would have to be very largely increased. It is not easy to estimate whether the demand could be met among retired officers of the militia.

Provision of Men. A popular cause would prevent any difficulty in this matter. Men would be raised in their company divisions, and should be well clothed, armed and equipped before being embodied with their battalions.

Provision of Horses. The required numbers should be easily obtained. About 6000 riding horses and 1000 draught would be sufficient for all purposes, excluding transport.

Arms and Equipments. All arms come from England. The infantry weapon is inferior, and it is not known that there is in the country a supply anything like sufficient for the force under consideration. Equipment is the same. There is no supply of guns other than those in use, and the artillery wagons are not fitted for carriage of rifled projectiles.

Ammunition. Small-arm ammunition is made in Canada; the factory at Quebec being able to turn out 2½ million cartridges annually with the present establishment. Rifled projectiles are also being made there now.

Clothing. All clothing is made in Canada.

Medical Service. Few battalions have any ambulance service. The whole would have to be organized on outbreak of war.

Transport. No nucleus of transport is kept up. This also

would have to be organized regimentally, the wagons of the country being used.

Intrenching Tools. None are carried. Wagons carrying the ordinary implements would have to be attached to battalions.

ORDER OF BATTLE.

ARMY OF THE EAST.

Eastern Division.

New Brunswick Brigade.
71st Battalion, Fredericton.
67th " Woodstock.
62d " St. Johns.

Second Quebec Brigade.
23d Battalion, Sta Marie
92d " St. Anselme.
55th Battalion, Inverness.
Divisional Battalion, 17th, Lewis.
Artillery, Quebec Field Battery.
" Woodstock Field Battery.
Cavalry, 8th Regiment.
Engineers, Brighton Company.

Total: 7 battalions, 4 squadrons, 8 guns and 1 Co. Engineers.

Quebec Garrison.

First Brigade.
61st Battalion, Montenaguy.
88th " Kamouraska.
89th " Fraserville.

Second Brigade.
8th Battalion, Quebec.
9th Battalion, Quebec.
87th " Quebec.

Third Brigade.
70th Battalion, St. Geneviève.
81st " Pont Rouge.
6 Garrison Batteries.

Cavalry—Quebec Hussars.

Total: 8 batteries, 4 squadrons, 6 garrison batteries.

First Army Corps—First Division.

First Brigade.
53d Battalion, Sherbrooke.
54th " Richmond.
58th " Cookshire.

Second Brigade.
52d Battalion, Knowlton.
79th Battalion, Waterloo.
60th " Clarenceville.
Divisional Battalion, 57th, Hemmingford.
Cavalry, 5th Regiment.
Artillery, Richmond Field Battery.
" Granby Field Battery.

Total: 7 battalions, 4 squadrons, 8 guns.

Second Division.

First Brigade.
80th Battalion, Gentilly.
85th " Joliette.
86th " Louiseville.

Second Brigade.
84th Battalion, St. Hyacinth.
64th Battalion, Beauharnois.
50th " Huntingdon.
Divisional Battalion, 11th, St. Andrews.
Cavalry, 6th Regiment.
Artillery, Montreal Field Battery.

Total: 7 battalions, 4 squadrons, 4 guns.

Third Division.

First Brigade.
1st Battalion, Montreal.
3d " Montreal.
5th " Montreal.
Second Brigade.
6th Battalion, Montreal.
65th Battalion, Montreal.
85th " Montreal.
Divisional Battalion, 75th, St. Martin.
Artillery, 2 Garrison Batteries.
Engineers, Montreal Company.

Total: 7 battalions, 2 garrison batteries, 1 Co. Engineers.

Second Army Corps—First Division.

First Brigade.
21st Battalion, Windsor.
24th " Chatham.
27th " Sarnia.
Second Brigade.
26th Battalion, London.
25th Battalion, St. Thomas.
7th " London.
Divisional Battalion, 22d, Woodstock.
Cavalry, 1st Regiment.
Artillery, London Field Battery.

Total: 7 battalions, 4 squadrons, 4 guns.

Second Division.

First Brigade.
39th Battalion, Simcoe.
37th " York.
44th " Clifton.
Second Brigade.
19th Battalion, St. Catherines.
13th Battalion, Hamilton.
38th " Brantford.
Divisional Battalion, 77th Dundas.
Cavalry, 2d Regiment.
Artillery, Welland Field Battery.
" Hamilton " "

Total: 7 battalions, 4 squadrons, 8 guns.

Third Division.

First Brigade.
28th Battalion, Stratford.
29th " Berlin.
30th " Guelph.
Second Brigade.
31st Battalion, Owen Sound.
32d Battalion, Walkerton.
33d " Goderich.
Divisional Battalion, 35th, Barrie.
Cavalry, Body Guard.
Artillery, Guelph Field Battery.

Total: 7 battalions, 4 squadrons, 4 guns.

Kingston Field Division.

First Brigade.
41st Battalion, Brockville.
42d " Brockville.
56th " Prescott.
Second Brigade.
49th Battalion, Stirling.
15th " Belleville.
40th Battalion, Coburg.
Divisional Battalion, 43d Ottawa.
Cavalry, 3d Regiment.
" Prescott Troop.
Artillery, Ganausque Field Battery.
" Ottawa " "
" Port Hope " "

Total: 7 battalions, 5 squadrons, 12 guns.

Total strength of Army of the East: 43 battalions, 21 squadrons, 32 guns and 2 companies Engineers, or 47,800 men.

ARMY OF THE WEST.

Kingston Local Division.

First Brigade.

Foot Guards, Ottawa.
43d Battalion, Ottawa.
47th " Kingston.

Second Brigade.

16th Battalion, Picton.
45th Battalion, Bowmanville.
46th " Port Hope.
Divisional Battalion, 14th Kingston.
Cavalry, Dragoon Guards.
Artillery, Kingston Field Battery.

Total: 7 battalions, 4 squadrons, 4 guns.

Toronto Reserve Division.

First Brigade.

20th Battalion, Milton.
2d " Toronto.
10th " Toronto.

Second Brigade.

24th Battalion, Whitby.
36th " Brampton.
12th " Aurora.

Artillery, 2 Garrison Batteries.

Total: 6 battalions, 2 garrison batteries.

Total strength of Army of the West: 34 battalions, 16 squadrons and 20 guns, or 34,100 men.

Total force for defence of the frontier from Quebec to Detroit: 81,900 men.

General Remarks.

Let us suppose the proposed alliance between Russia and France to be an accomplished fact. British occupation of Egypt may be sufficient excuse for hostile action against England on the part of the latter Power, whilst India will always remain a favorite objective of the former.

It is not beyond the range of possibility, perhaps even probability, that England may one day be opposed to these two Powers combined. In that case all the British troops located in India would be required there, and more besides. Suppose England should now attempt to act offensively against the Russian line of communications to the Caspian Sea, operating from the Black Sea, all England's naval strength would be required to oppose the Russian Black Sea fleet and to clear the Mediterranean of French vessels. All the regular troops would be required for the offensive operation after providing for defence at home. Fear of German invasion might necessitate the greater part of French troops being kept on French soil.

Now, England's weakness in 1812 proved to be America's opportunity. At such a time as this Canada can expect no help from England. A small Russian naval expedition would suffice

to capture and hold Vancouver and the railway terminus. Whatever naval force England might be able to detach to Halifax and Bermuda to protect her interests in the Atlantic will only be sufficient for that purpose, and would not be available for operating in the St. Lawrence.

We know by experience that operations of war do not drag along now as in former years. It was written, in 1862, by a well-known General: "If our Minister at Washington is deceased, if our generals are indolent and supine, a war may be declared and an invasion take place before even the ministry in England are aware that hostilities are contemplated." This applies more strongly now, when every mile of country is intersected with railways, even though ocean cables have brought England and her colonies into closer union.

Under such circumstances as these, then, the Canadian Militia would alone be available for the defence of Canadian soil. The number which could be raised on the basis of the present peace organization has been shown, but the complete work of mobilization, from the raising of men, through all the stages of arming, equipping, clothing and combining into units, up to the final concentration at the strategic points, would occupy an interval of time which could only be calculated by months.

What, then, would be the effect of a sudden advance upon Montreal by a well-organized hostile force of 20,000 men? If such a force could be assembled on the frontier on the tenth day after declaration of war, three or four days more would bring it to Montreal, if unopposed, or a successful combat will be fought near Chambly against an inferior and incompletely organized force. Holding now the southern exits from the city, a part of the army may pass above Montreal, and the city will be invested. With re-enforcements being rapidly sent forward by rail and route march, nothing need be feared in regard to communications. A complete syncope of trade will soon produce the required result. Simultaneous union operations against other parts of the line will suffice to keep the troops of these districts in their places.

We have said that a popular cause would overcome all difficulty in regard to raising the small number of men required by our estimate; but it must be a cause popular with the classes, both French and English Canadians, otherwise we should look for a large migration over the border of those liable to be called upon to serve.

Canadians will fight, and fight well, whatever the disparity of numbers; but without preparation, organization and a sufficiency of warlike stores, strong arms and stout hearts are of little avail. Fortunately we are slowly but surely advancing under the present military régime; we have already a standing force of some 800 men represented in the permanent Military Schools; we look for the re-armament of the Infantry battalions with a superior weapon, and a more complete training of these battalions is constantly urged. Rifle and Artillery associations are active; and a million dollars, annually, covers the cost of the whole show.

Errata in Part I.—(JOURNAL No. 29.)

In table, page 91.

For "Monthagus" read "Montenaguy."
For "Mortar Battery" read "Mountain Battery."
The 18th Battalion has since been disbanded.

On page 93.

For "Monteuaguy" read "Montenaguy."
For "28 battalions" read "8 Battalions."
For "troops" read "troop."

THE PNEUMATIC DYNAMITE TORPEDO GUN.

By FIRST LIEUT. E. L. ZALINSKI, U. S. A.

Fifth Artillery.

COINCIDENT with advances in the arts of civilization, we find rapid advances in the arts of destruction. Advances made in the strength of armor and hulls of ships of war are met by using more powerful guns, and resorting to the high explosives carried in submerged torpedoes, movable and stationary. Neither the attack nor the defence are long permitted to retain a marked superiority.

Since the invention, development and use of high explosives, the problem of projecting charges of the same in shell from powder guns, has been presented for solution to the Military Engineer and Artillerest. Relatively small charges have been thrown from time to time with varying success, but ending most frequently disastrously. Even when successful, the amount inclosed in the shell and the condition of the resulting action were such that but little gain over shell charged with powder has been observable. The probable reasons for this will be discussed hereafter.

Efforts have also been made to project *through* the water, either at the surface or below it, larger charges than appeared feasible in powder-gun shell, with a view of causing the explosion against the weaker and usually unarmored or lightly armored portions of a ship below the water line; the effect of perforation here would necessarily be more fatal to the ship. The charges have been carried by locomotive machines, the propelling agents being engines operated by compressed air, gas, electricity, or energy stored up in a fly-wheel, or similar device.

They have also been propelled directly by the action of gas emitted by a rocket-powder composition. The great efforts

made in this direction, and the expense of the machine used to throw only a single charge, imply that the solution of throwing *large* charges out of powder guns, considerable distances, does not appear to be perfectly practicable. Even if it could be so practicable, there are situations where the great weight of the powder guns, having requisite caliber, would be inadmissible.

With a view of developing a machine to safely project torpedoes containing very large charges of the high explosives to distances as great, or even greater than attainable with locomotive torpedoes, and with greater speed and accuracy, the so-called "Pneumatic Dynamite Torpedo Gun" has been devised.

EVOLUTION AND DEVELOPMENT OF THE MACHINE.

The first Pneumatic gun of the series was designed and constructed by Mr. Mefford, of Ohio, in 1883. This gun was brought to Fort Hamilton, New York Harbor, for trial, in January, 1884. The gun presented for experiment was substantially a seamless brass tube, 28 feet in length, 2 inches interior diameter, 2.5 inches exterior diameter (walls ¼ inch thick). The air reservoir had a capacity of about 12 cubic feet. It was connected with the breech of the gun by means of a flexible rubber hose. Where the hose was attached to the reservoir an ordinary two-way brass cock was fixed, which served as a firing valve. It was opened and closed by hand. The method of admitting and cutting off the air supply was too crude to permit any satisfactory conclusions to be based on the result obtained, as the action should be entirely automatic and free from the varying personal equation of the operator.

Projectiles were thrown by this gun, across the Narrows, a distance of about 2100 yards. The pressure used was only 500 lbs. The results obtained were, at first glance, very surprising. Consideration of the matter indicated, however, that the gun presented the equivalent of an extreme example of recent development in ballistics, *i. e.*, a very slow powder but a very long bore of gun.

The compressed air replaced the slow burning powder, and although the initial pressure was comparatively low, it was continued for a longer period of time. Whilst the maximum length of bore of powder guns is about 32 caliber, the air gun was 168 caliber in length. Furthermore, whilst powder-gun pressure falls very rapidly, the pressure of the compressed air in the air-gun reduced much less rapidly.

The experience with the 2-inch gun indicated the following desiderata:

1st. The valve should be automatic in its action as to opening and closing, and should permit the escape of a uniform volume of air between the two events.

2d. The length of bore of gun should be as great as can be readily manipulated.

3d. The pressure to be used should be at least 1000 lbs.

4th. The gun should be capable of being easily trained.

With these points in view, the mechanical details of a 4-inch gun were designed by Mr. Geo. F. Reynolds, and built at the Delamater Works. Some of the features in its design were tentative in character, it being the intention to use it principally for experimental purposes, with a view of obtaining data and experience leading to larger constructions. The gun barrel was made of three sections of seamless tubing of 4 inches interior diameter, and $\frac{3}{16}$ inch thick. The total length of bore was 40 feet, or 120 calibers. The valve was automatic in its opening and closing. It was required to open rapidly, permit a certain uniform volume of air to escape, and close about the time of the arrival of the projectile near the muzzle. It might be considered as a *time* valve or as an air meter.

The 4-inch gun upon completion was mounted on the glacis outside of Fort Hamilton.

To produce the requisite uniformity of results, required many modifications of details which were the outcome of numerous unsuccessful as well as successful experiments. The uniformity of range obtained, where the projectiles had the same weights and centers of gravity, was very noticeable, and indeed this was to be expected where the pressures were so uniform and so entirely under control. The simple ballistic qualities of the machine having been brought to a fairly satisfactory state, the next question to determine practically was as to the *safety* of projecting the high explosives in comparatively large quantities, the vehicle, the shell, being very *thin*.

The system permitted an assured gentle initial action upon the shell, as the valve could be placed in such position as to interpose any desired length of air cushion between it and the shell.

Progressive experiments with shell charged with dynamite showed that no air cushion was required, and that the shell could be placed as close to the valve as mechanically convenient.

The question of properly exploding the shell came next under consideration.

Ordinary percussion fuses of fulminate of mercury were used at first, being placed in the point of the conical head. These fuses did not act uniformly, and some failed to explode the charge. Further experiment with copper capsules of fulminate demonstrated that whilst some would explode upon very slight concussion, others would be entirely upset and deformed without resulting in explosion. This occurred with the most sensitive ones obtainable.

Another noticeable fact was that shell charged with 17 lbs. of dynamite, having the percussion capsule in the front, upon striking and exploding on the shores of Fort Hamilton, sometimes failed to produce any marked effects. This result was very unexpected, but it was assumed that it was probably due to the initial point of the explosion having been in front.

It was assumed that *time* was required for explosion of the entire charge—that the gases evolved by the explosion of the layers in immediate contact with the target, tended to throw *back* the gases afterward evolved from the portions of the charge in rear. It therefore appeared desirable to make the initial point of explosion at the *rear* portion of the charge, and to prevent an explosion at the point from simple impact; that the explosion must be made to take place an instant *before* the body of the projectile had actually struck the target. It furthermore appeared necessary to devise a fuse, which, while not abnormally sensitive to explosion from shock when in the bore of the gun, would act upon the slightest touch when striking the target, and that its point of initial ignition could be placed at any desired point within the charge, or could be made to occur simultaneously, at a number of points. In view of the unsatisfactory experience with ordinary percussion arrangements, it occurred to me to call to my aid the electric current, to inclose a small battery in the shell with suitable circuit arrangements and electrical primers.

The fuse problem still presented difficulties as the requirements appeared to be conflicting. These were:

1st. That in striking a rigid target, such as the side of a ship, that the circuit should be closed an instant *before* full impact of the projectile.

2d. Missing the ship and entering the water, that *explosion* should take place an instant *after* striking, so that the charge

might be fully buried in the water and produce its maximum on the enemy, if within the effective danger radius.

3d. Failing in this, to explode after reaching the bottom, and so that this last action may take place at will, without the other.

4th. To cause the circuits to remain certainly open until the shell has left the bore of the gun.

The problem presented for solution was found intricate and complex. Very many practical difficulties were found to exist. These have all been eliminated, and the manifold and apparently diametrically opposite modes of action have been successfully obtained. As soon as a suitable battery had been selected, arrangements were made to try experiments upon iron plates to determine the best details of arrangement of the charge and of fuse. The following experiments were tried:

An iron target was constructed of plates of the English ship *Nankin*, sunk in the harbor and being raised by the Engineer Department. The plates were supported against the interior parade wall and the gun was placed outside of the Fort, at the sally-port, 60 yards from the target. A blank shell charged with sand, total weight 30 lbs., was fired. It penetrated three plates, aggregating 2.5 inches. A similar shell, charged with dynamite, having no fuse, intended to explode on impact, penetrated only a single plate, and its effect was actually *less* than the blank shot previously fired. Another shell fired with a detonating fuse in the front of the charge did but little more damage. An electrical fuse was then arranged so that the circuit should be closed when the body of the shell was one-eighth inch from the target. The primer was placed in the rear part of the charge. To further insure against premature explosion by simple impact, a thin layer of cotton waste was placed in the front of the shell. The resulting explosion was the most effective produced; the six plates of the target, aggregating 4.5 inches, being broken through and indented in nearly a circular area of about 18 inches diameter. The stone wall in the rear was also somewhat broken by the shock.

It was evident, from the results obtained, that the effects to be produced by the explosion of the dynamite shell would not be limited to simple puncturing of a target, but that it would produce cracks and breaks at points distant from the point of impact. This was shown in some experiments upon the stern posts of the *Nankin*, forging about 5 inches by 8 inches in cross-section. Charges of 3 lbs. were exploded upon it. They simply indented

the piece at the point of placement, but broke pieces of 2 feet in length at the extremities 6 feet and 8 feet distant, and produced large cracks at other points.

During the progress of the experiments with the 4-inch gun, an 8-inch gun was designed. It was determined to endeavor to make the gun at once of a capacity which would place its value beyond cavil. The charge to be thrown was to be at least 100 lbs.; and a range of about two miles, or that of the extreme range of the largest movable torpedoes, such as the Sims' Electrical Torpedo. The mechanism was to be such as to enable one man—the person sighting—to train the gun, elevate it, and fire it without moving his eye from the sight. The mechanical details of this gun were designed by Mr. Nat. W. Pratt, Mechanical Engineer, of the Babcock & Wilcox Company.

The 8-inch gun was mounted at Fort Lafayette in August, 1885. The gun tube is made of four lengths of wrought-iron tubing five-eighths inch thick, lined with one-eighth inch seamless brass tubing. The barrel is supported on a truss suitably braced. The breech is closed by a simple gate which opens inward toward the side of the valve. The entire system of the gun barrel and truss are revolved around two trunnions projecting from the breech piece, which last is of cast iron. The trunnions rest in two hollow cast-iron uprights, resting upon the chassis. The chassis is a front pintle arrangement, resembling in general appearance the chassis of heavy guns. Two cylinders with suitable pistons, sheaves and wire rope are attached to the chassis, the ends of the wire rope being attached to hooks in the platform. One cylinder operates the traversing sheaves by pulling the wire rope. The other cylinder acts upon a plate forming the rear end of the gun truss, by means of two links attached to the same, and elevates the gun. Both cylinders are operated by means of two training wheels operating suitable valves. Besides these wheels, there are two levers which regulate the rapidity of action of the training mechanism. The sight rests in Vs attached to the left trunnion. The firing lever operating the valve is placed on the left side, within reach of the person sighting, so that the firing can be done without leaving the sight. A pressure gauge is placed so the person sighting can readily see the pressure available, and thus, when needed regulate the elevation.

In short, the arrangement is such that, after the gun is loaded

the manipulation of it, including firing, is under the *direct* control of a single person, a desideratum in all artillery machines.

The air reservoir consists of wrought-iron tubes 12¾ inches exterior diameter, and of a total capacity including passages to the valve of about 137 cubic feet. These tubes are supported on the chassis, four on each side, in two tiers. They enter, by means of connecting nipples, into the casting supporting the trunnions of the gun. This design was also somewhat modified on account of the temporary character of the emplacements on which it was to be used.

Whilst the firing reservoirs of the present gun are fixed on the chassis, a gun for permanent emplacement, now building, is so arranged as to have the valve and all parts under continued pressure and the air reservoir in a covered well beneath the gun platform. To this a service reservoir is to be connected with a large central auxiliary reservoir, into which the compressor engines are constantly pumping, a higher pressure being maintained than that used in firing. The auxiliary reservoir connection pipe is to have a cock by which the air is cut off from the gun reservoir. As soon as the gun is fired this cock is opened, and whilst the projectile is being inserted the pressure is restored to the desired point. The opening of the cock can be automatic, coincident with closing the firing valve of the gun. In this way the firing can take place as rapidly as the shell can be inserted into the bore and the gun pointed, the restoration of the pressure being a matter of only a few seconds.

At each fire only a small percentage of the pressure in the gun reservoir is used, and this only need be replaced. It is not absolutely required to restore the pressure, as the same range may be obtained with lower pressure by increasing slightly the elevation or by changing the "cut off" of the valve. An example of this was witnessed at the recent firing at Fort Lafayette. The initial pressure was 1000 lbs., and the elevation 14°. The "cut off" adjustment having been varied, the first round gave a loss of 47 lbs., and a resulting range of 1816 yards, and the second round gave a loss of 68 lbs., and a resulting range of 2492 yards. Range tables for introducing both variables are to be provided the gunner on a brass plate attached to the pressure gauge.

Having the valve and all parts under continuous pressure below the terreplein, avoids danger of leaks at a movable joint and makes the manipulation easier.

The 8-inch gun has been worked with 1000 lbs. pressure. With this pressure and an elevation of 35 degrees, a shell carrying 60 lbs. of explosive has attained a range of 2¾ miles, and a shell containing 100 lbs. charge, a range of 3000 yards, with 33 degrees elevation.

The general character of shells used are shown by the specimen before us. The tube was made both of seamless brass and of low steel. The tail was of pine or bass wood, strengthened by wire winding at various points. The point was of cast iron. The entire projectile, including the tail is now to be made of metal.

A very large number of experiments have been tried in arriving at the details of the projectiles. As the gun was a smooth bore, the projectile partook somewhat of the character of an arrow, and was retained point foremost by retaining the center of gravity well forward and by resisting portions of the tail piece. It was found that it was necessary to make the tail quite long in order to maintain stability of flight. Efforts have been made to shorten the tails by various devices of wings or vanes which were forced outward by springs, beyond the body of the projectile. Some of these have given fairly good results.

Col. Hamilton designed a projectile having spiral wings on the tail shaft. This gave an excellent flight. The wooden tails used were necessarily cumbersome and unreliable as to strength, and experiments were made to develop a projectile which should be entirely metallic. A form has been evolved which is essentially the projectile designed by Col. Hamilton, but having the spiral vanes comparatively short. This form has the advantage of reducing the total weight of a projectile for a given charge, can be made more uniformly, and can be more easily stored on shipboard, as the long tail piece can be detached until required for use.

With the wooden projectile it was found necessary to make the point quite heavy in order to throw the center of gravity well forward. It is thought that with the all-metal projectiles having the spiral tails, that rotation is quickly set up, during flight, and that the position of the center of gravity is not of so much importance, or at least, it need not be so far forward. Experiments are now under way to determine this. Should it be found to be the case, the point will be made thin, of just sufficient strength to resist the shock when striking water. In striking a solid target the immediate point will crush in, and a larger portion of the explosive will be brought into direct contact with it, at the in-

stant of explosion. The fuse circuit-closing arrangement will be placed so that *before* complete collapse, the explosion is produced. It will have the advantage of producing the proper circuit closing, even when striking a target, such as a deck, not normally. The new projectile will have its circuit-breaking arrangements of such character as to require no outside manipulation, but is brought into action by the air pressure which assures broken circuits as long as the shell remains in the bore of the gun.

In the form used up to the present time, the circuit breaking was dependent upon the bearing of projecting plungers against the bore of the gun, and it was found practically inconvenient to manipulate the safety pins which were withdrawn after the projectiles had been partially inserted. This incurred loss of time. Again, with the wooden-tailed projectiles a separate gas check was used which was inserted after the projectile was in place. In the new form of projectiles, the gas check is at the base of the body of the projectile. Thus the loading consists simply of the placement of the projectile into the bore of the gun and closing the breech. Great rapidity of fire will thus be possible, and with trained men, I believe that the gun can be fired at the rate of once per minute.

In a trial before a U. S. Naval Board, in June, 1886, with untrained men and without great effort being made, five rounds were fired in nine minutes and forty seconds. This was with the old form of projectile involving the placement of the gas check, etc. The accuracy of fire of these five rounds was also remarkable. The range was 1613 yards, the elevation being 10°-40′, the pressure 1000 lbs., and cut off valve set so as to produce 50 lbs. loss. Four of these attained exactly the same range, the other having gone only seven yards beyond. The maximum lateral dispersion was equivalent to only 6.2 yards. The wind was quite variable, but no attempt was made to follow it except once, just after the first round.

To the professional mind, it naturally occurs that it would be well to resort to rifling, dispensing with the long and cumbersome tail. To rifle a projectile so long and so low in density as the one in use would involve an exceedingly rapid twist. According to Professor Greenhill's formulae, a twist of one in thirteen is required for a cast-iron shell 8 calibers in length. This will be about the average length of the dynamite shell without the tail, being, however, somewhat shorter in the larger calibers. The density of the charged shell will be much less than of the common iron shell.

Hence it is probable that a twist of about one in eleven will be required. To impart so sharp a twist will put a very considerable torsional strain on the thin walls of the shell as well on the (proportionately) equally thin walls of the gun. Again, the explosive will have to sustain an additional shock due to the very high angular velocity imparted to the shell. There is very great danger from the heat which will be generated in the friction of the projectile, whilst being forced through the gun bore.

Whilst, as an Artillerist, my natural predilections were for rifling, consideration of the foregoing facts led me to make haste slowly in this direction. I had constantly before me the experiences gained at the Proving Ground at Sandy Hook, and in foreign services, where the usual results of the experiments of firing the high explosives from rifled powder guns, was a final dissolution of the gun. As in my experiments, the available supply of guns which I could burst, was very limited, I desired to put off such untoward event as long as possible.

Consideration of the matter has led me to see a number of ways by which some of the difficulties I mention may possibly be overcome. I have now a 2-inch rifle gun in which I shall test the matter even to the final bursting of the gun, establishing by my experiments, if possible, the limits to which the rifling can be used with safety.

The feasibility of using gunpowder for the propulsion of shell charged with high explosives is continually broached. It has been frequently tried, but invariably with final disastrous results, where the experiments have been carried up to moderately *large* charges. By large charges, I refer to shell charges not less than fifty pounds and reaching up to one thousand pounds, and even to shell charged with a ton of high explosives.

The advocates, or rather the predictors, of the use of high explosives from powder guns also demand *penetration* before explosion. If *large* charges are to be thrown, the shell must necessarily be made thinner, and it is very doubtful if it will then withstand the concentrated blow it receives upon striking the target, so as to penetrate even a moderate thickness of armor. The battering shell of the 100-ton gun contains a bursting charge of only twenty-five pounds of gunpowder. It would seem that the walls of the shell would have been made as thin as consistent with ability to perforate armor without breaking up.

Assuming that twenty-five pounds of a high explosive could be

substituted for the gunpowder, it is very doubtful if it could be carried through heavy armor successfully before explosion. There is no record of large battering shell fully charged with gunpowder having perforated armor over six inches in thickness, without explosion, until after perforation. On the contrary, explosion takes place prematurely, almost immediately upon impact, with the result of less injury to the target than that produced by an uncharged shell. Much more surely will this be the case if a high explosive be substituted for the gunpowder, as the bursting charge, unless the shell cavity is well cushioned. To do this involves reduction of explosive capacity. The energy available, after breaking up the very thick and tough walls of steel shell, will be but little greater than produced by the gunpowder. The effect as to material injury or man-killing power will not much exceed that producible by the shell charged with gunpowder.

In firing a shell from a powder gun, the walls of the shell must necessarily be sufficiently strong to withstand the initial shock. This limits somewhat the capacity for bursting charge, even where armor-piercing is not sought for. If a high explosive is used, some cushioning device is requisite, and a further reduction of capacity ensues.

Assuming that a shell charged with some of the high explosives can be thrown with safety from a powder gun under normal conditions of pressure, it is known that abnormal pressures, varying therefrom as much as 5000 to 12,000 pounds per square inch, are not infrequent. This may be looked for especially when the gun is warmed by continuous firing. In addition to this, the shell and the contained charge may become warmed by remaining in the hot gun-bore some little time before being fired. The high explosives increase very rapidly in sensitiveness by slight increments of heat. If, then, with this condition of increased sensitiveness, we have in addition an abnormal pressure, a premature explosion is very likely to occur. Much more will this be the case when the bursting charge is one of the high explosives. In this connection another matter is to be considered. It is well known that the high explosives are capable of producing more or less violent explosions depending upn the character of the initial shock or detonation. The more insensitive the explosive the more powerful must be the detonating charge to produce an explosion of the first order. Fulminate of mercury appears to be requisite in all cases. But fulminate of mercury is even more

sensitive to shock than either ordinary dynamite or dry gun-cotton; hence the resulting shock must be tempered so as not to explode the more sensitive *detonating* charge rather than the specially insensitive *bursting* charge. Wet gun-cotton has been substituted for powder charges, but being quite wet reduces its explosive ability nearly to par with gunpowder. Particularly is this the case where no detonating charge is used of dry gun-cotton and fulminate of mercury. Where the explosion takes place by simple impact, not alone is it of a low order; but, as the initial point of explosion is from the front, the resulting injury to the target is less than from a blank shell.

This was exemplified in the experiment previously mentioned, as also in some experiments made at the Naval Proving Ground by Commander Folger, U. S. Navy.

From experiments made by Commander Folger he arrived at the following conclusions, being in some respects similar to those above stated. These are as follows:

"(*a.*) Using a weak shell charged with the high explosives, no material injury would result to the over-water defense of a modern armor-clad, even with gunpowder as the propulsive force, and using greatly increased bursting charges. The effects, *nil* with low velocities, will be equally valueless with high velocities.

"(*b.*) It is believed that, using a strong walled *steel* projectile, the explosion occurring at impact at an elevation of temperature of less than 300 F., the effects will be less notable than with similar projectiles charged with gunpowder."

In the experiments from which these deductions were made, the explosions were of a low order, being produced by simple impact, from the *front* end. The importance of having the initial point of explosion in the *rear* has been already noted. Commander Folger quotes other experiments where the explosion of disks of gun-cotton on iron plates gave very markedly increased results when the initial explosion was on the side farthest from the plates. By the Pneumatic gun system full detonations can be produced, evolving the maximum energy of the explosions used, and the initial detonation can be assured to take place from the *rear* end, producing the maximum injury of the target.

Where very large charges are to be used, the electrical primer enables us to have a number of centers of simultaneous ignition should it be found desirable. The possibility of this being

required is mentioned by Commander Folger, but he cites no concrete experiments upon which he bases this. I have been prevented, by the nature of my surroundings at Ft. Lafayette, from trying necessary experiments, with large charges, to ascertain definitely. In firing and exploding charges of six pounds of explosive gelatine the concussion was so severely felt on the adjoining shores as to lead to earnest complaints. In consequence of this, I was prohibited from exploding at Ft. Lafayette larger charges than three pounds.

The torpedo shell of the Pneumatic dynamite gun has two fields of action when considered as an element of sea-coast defense: 1st, against the over-water armored hull; 2d, against the under-water hull.

We will first consider the effect of the explosion of dynamite against armor and the probable resulting injuries to the over-water hull.

General Abbot, in the paper read before this Institution, accepts the Scandinavian adaptation of Capt. Lauer's formula, $W—3.\ 3d^2$ where W—weight of dynamite and "d"—thickness of wrought iron armor. This is based on experiments where the explosive was tamped with 8 inches of *loose* earth as representing 18 inches of water. My own experience indicates that 8 inches of loose earth is very far from being the equivalent of 18 inches of water. Much less will it be equivalent to the tamping effect of the resistance of the inclosing case and the remaining energy of several hundred foot tons with which the torpedo shell will strike. It is, therefore, within the mark when I accept for the purpose of argument this formula.

I recognize that the relative length of the charge in the shell may offset, to some extent, the better tamping effect of the remaining energy and inclosing envelope when acting against an above-water target. As I purpose using uncamphorated explosive gelatine, I will substitute its equivalent, 142 as compared to Dynamite No. 1 taken at 100. Doing this, I obtain for

100	lbs.	a perforation	of	6.6	inches.
200	"	"	"	9.3	"
400	"	"	"	13.2	"
700	"	"	"	17.4	"
1000	"	"	"	20.4	"

Now this does not mean simply a perforation of so many inches as locally as if penetrated by an ordinary projectile. There will be a very considerable area broken in about the immediate point of

impact. Furthermore, there will be a very great transmitted vibratory shock, which will seek out and break the weaker points in the vicinity of the explosion. Of this I have had tangible evidences in my own experiments previously cited.

Very few vessels have a maximum thickness of armor of twenty-four inches, and that over only a very small area. The decks rarely have more than 4 inches of armor. These form the larger part of the target presented to the high angle fire of the Pneumatic gun, and will easily be crushed in by even a shell carrying 100 pounds of explosive gelatine. Naturally the points aimed at will be the more vulnerable parts. I question, however, whether a shell containing 400 lbs. striking the most heavily armored turret will not, by the transmitted shock, render the inmates *hors de combat;* besides impairing the manipulating apparatus of the turret, the glacis and decks in the vicinity will be broken. I venture to say that, although 1900 lbs. of dynamite is assumed by Gen. Abbot as requisite to break in 24 inches of armor, yet the most earnest believer in the correctness of this formula would not feel entirely comfortable within a turret so armored when a charge of only 400 lbs. of explosive gelatine is detonated against it.

The high explosives have not been thrown in large quantities in any way until recently (by the Pneumatic gun only). There are, therefore, no tangible experiments wherefrom definite conclusions can be drawn as to degree of perforation or breaking in of armor. As soon as these take place it will be possible to determine the size of the charges to be thrown to accomplish any desired results. But, primarily, the object in view is to produce submarine explosions. Regarding the effectiveness of these as against the under-water hull, there is less question.

Thus far a gun capable of throwing only 400-lb. charges of explosive gelatine is designed for immediate construction. But it is perfectly feasible to throw any sized charges up to even one ton, should this be deemed necessary, to break in any armoring it is possible to carry.

An experiment tried by Commander Folger, U. S. Navy, is often quoted. In this, a charge of 100 lbs. of dynamite was suspended against an iron target consisting of eleven one-inch plates, strongly bolted together, and backed by 20 inches of oak, well braced. The result was an indentation of only about 2 inches, extending over an area of two feet. From this, the conclusions

are published, "that a modern armor-clad will not receive material injury by the explosion in superficial contact with iron overwater plating of very large charges of dynamite." The superficial contact of the charge, as exploded, did not to my mind represent the conditions at the instant of explosion of a shell from the Pneumatic Gun. The element of tamping was here entirely lacking. To test this matter in a small way, the following experiment was tried: A cartridge of 8 ounces of dynamite was suspended in "superficial contact" with an iron plate $\frac{3}{4}$ of an inch thick, and there exploded. The result was a simple indentation of the plate. A charge of 8 ounces was again suspended against the plate, but over it was loosely suspended a piece of angle iron open at both ends and of such size that the inscribed circle between its sides and the plate was less than the cross section of the charge, which was cylindrical. Thus there was no direct pressure against the cartridge. Yet a large elliptical hole was blown through the plate considerably longer and broader than the cartridge. This experiment was repeated with almost identical results; when two plates were placed together a hole was blown through *both* plates.

Regarding the effect of the explosion, when occurring under water there appears to be less question, except as to the size of the charge. Up to recently less than 100 pounds of gun cotton have been considered sufficient. A natural sequence of the general use of auto-mobile torpedoes, such as the Whitehead, has been the strengthening of the under water hull and at the same time increasing the cellular subdivision of the hull. This renders larger charges desirable. The Pneumatic gun system makes this perfectly feasible. It is simply necessary to establish the size of the charge to be thrown.

In the development and purchase of Whitehead torpedoes and the torpedo boats especially constructed to carry them, the Governments of Europe have spent about one hundred millions of dollars. Yet the relative efficiency of this falls far below the torpedo projected from the Pneumatic gun.

The Whitehead torpedo, whilst having a possible range of 800 yards can hardly be said to be accurate even at 200 yards. Particularly is this the case when discharged from a vessel in motion, and a very great fault has recently been found with this. It is subject in its flight to the varying and unseen eddies, currents and waves. It must make an absolute hit to produce results. It may be stopped by booms or netting. It carries so small a charge

that even if in contact with the enemy's hull, doubts are expressed of its efficiency. Its speed at most is only 25 knots. It cannot, therefore, be used directly forward by a vessel advancing to attack another, as it is in danger of running into the explosion of its own torpedo. It is relatively bulky and expensive. Very few can well be carried, and each time one is used a considerable proportion of this portion of the armament is thrown away.

The following quotation from a recent number of the *Pall Mall Gazette* may be interesting:

"Moreover, in firing from the bow, the slightest twist at the immense rate of speed of the torpedo at the moment of leaving the boat would be enough to account for any eccentricities of behavior. More than one English officer has been startled by discovering his own torpedo looking him in the face."

The Lay-Patrick torpedo has a speed of 20 miles; weight, 4,000 lbs.; carries a charge of 125 lbs., and costs about $8000 each. The Sims electrical torpedo has a speed of about 11 miles, weighs also about 4000 lbs., and carries a charge of 300 lbs. Of the Brennan torpedo little of detail is known in the United States, except that it, like the Sims and the Patrick, must be connected with the operating station by wires. In all of these a very long life artery is exposed to injury.

Two, if not all of these three, are expensive, and all are bulky, and relatively of no great speed. They must be seen the entire distance to be operated. This is a matter of no little difficulty at distances exceeding one half a mile, where there is any sea. If they can be seen by the operator for the distance of maximum range (supposed to be two miles for the Sims torpedo) the chances are fair that the vessel to be attacked will discover the approach in time to evade the blow. It should be noted that the greatest speed claimed for this last class of torpedoes is less than that of the most modern ships of war. All of the torpedoes mentioned can be stopped by booms or netting. The Whitehead torpedo must make an absolute hit.

In contrast to this, the torpedo shell of the Pneumatic gun has a number of important advantages. The proportion of weight of the shell compared to the charge is relatively small. They are comparatively light and inexpensive. A larger number of rounds can be carried. They have a field of action against the over-water hull as well as the submerged parts. They may be effective without making absolute hits. Neither booms or netting can stop

them. Their *mean* horizontal velocity for a range of two miles, is about 300 knots, as against the maximum velocity of 27 knots of the Whitehead, and very much less of the others mentioned. The attainable range is very much greater.

I do not wish to be understood that there are not some situations where I deem these submerged movable torpedoes to be of value. I would have some of these different types of torpedoes as a portion of an armament.

It is gratifying to know that in lieu of the inefficient Whitehead torpedo, we have an American invention which is very much superior thereto in every essential respect. I refer to the Howell torpedo, invented by Capt. John A. Howell, U. S. Navy. Whilst having some of the limitations mentioned, it is capable of doing more effective work at *close quarters* than is possible with the Whitehead.

It has been the rule in the United States to decry American inventions and neglect to adopt them until they have received the indorsement of foreign approval. This was the case with the Hotchkiss guns, and other foreign inventions. Is it not about time for us to judge independently of the merit of American inventions, and not belittle them?

ACCURACY OF FIRE.

The accuracy of fire of the Pneumatic gun is frequently brought into question, because it is a smooth-bore. The fact that the projectile cannot ballot as do the spherical projectiles in the ordinary smooth-bore gun, is lost sight of. On the other hand the Pneumatic gun has a uniformity of pressures exerted against the projectile, that may be considered absolutely impracticable to produce in any powder gun. With well-made projectiles it should therefore be practicable to reproduce results time after time. In other words great accuracy of fire should result from the theoretical conditions, and this has been accomplished practically. To illustrate this, I again call attention to the 5 rounds fired before the Naval Board. In this firing, four attained absolutely the same range, and the other was only 7 yards beyond these. It is true that the projectiles have a swaying or gyrating movement in their flight. But these gyrations appear to reproduce themselves so uniformly as not to affect the results. "They get there, all the same," in every sense. With the all-metal projectiles, the amplitude of vibrations appears to be reduced, and longer ranges are anticipated.

Comparisons are frequently made as between the high angle fire of the Pneumatic gun and the flatter trajectory of high-power powder guns. These comparisons are persistently made, notwithstanding the fact that it should be considered more as a torpedo projecting machine than as a gun, and that the comparison should be made with torpedoes rather than guns. Nevertheless, even when considered as a gun, its high angle fire is not altogether a detriment, and possesses important elements of efficiency as such, even when compared with high-power guns.

The experiences at the bombardment of Alexandria, and practice trials from English ships under the most favorable conditions, indicate that the great accuracy of fire of high-power guns is in a measure neutralized by the unstable platform which ship gives. From this it would appear that Naval combats, instead of taking place at ranges of from 5 to 10 miles, will rarely begin at much more then one mile range, and the tendency will be to come to closer quarters. Two miles may be considered the longest ranges at which attack of fortifications will take place. They will not waste their very expensive and very limited supply of ammunition for the larger guns, for the uncertain results obtainable at the longer ranges.

A few quotations from a very valuable and interesting paper on "The Protection of Heavy Guns for Coast Defence," by Capt. G. D. Clark, Royal Engineers, may be apropos here:

"At Sfax, after a remarkably deliberate fire of 2002 projectiles delivered under peace practice conditions, the 'defensive power' of the place is reported to have been 'practically uninjured.'"

Some facts drawn from the Alexandria action throw a strong light on the question of the accuracy of fire to be expected from ships.

"Altogether about 580 heavy and 340 light projectiles were fired at Fort Meks. Theoretically, of course, this work should have been silenced in ten minutes by the machine guns of the inshore squadron alone. That Fort Meks was able to reply for more than twice three hours to the overwhelming fire poured into it, clearly shows that low, level *barbette* batteries, if properly built, can well be fought.

* * * * * *

"The Inchkeith experiments, carried out in August, 1884, throw a certain light on the performance of shrapnel at Alexandria. In all, 30 rounds were fired from the 10-inch R. M. L. guns at ranges varying fron 850 to 3500 yards, the average being about 2330 yards. The condition so far as the ship was concerned was ideal. The sea was calm; the ranges could be obtained with great nicety; the firing was by single rounds, and excessively deliberate; undivided attention could be given to each round; there were no elements of disturbance; the Inchkeith gun presented an excellent target. On the first day, out of 15 rounds fired with battering charges, one ball found its way

into the emplacement. On the next day full charges were used and two good bursts were obtained in 15 rounds. Four dummies were hit; six balls struck the gun, six balls and three splinters the carriage and platform. In addition, one of the elevating wheels was broken and the traversing gear, placed at the rear of the platform, was disabled by splinters. The gun could still have been worked."

I regret that lack of time does not permit me to make more copious quotations from this instructive paper.

But we see that both naval combats and the attack of fortifications will be at such ranges as to make it possible to bring into play the Pneumatic gun.

The high-power guns, with their relatively flat trajectories will be thrown out as to range, more by slight changes of angle due to the unstable platform, than will the higher angle fire of the Pneumatic gun. The change of range due to error of judgment as to proper instant of firing, will be much greater with the high-power guns than with the Pneumatic gun. The variations of latter are more likely to come within the limits of error in judgment of distances.

Again, at the short ranges mentioned, the high-power guns, have, owing to the flatness of their trajectory, only the vertical projection of the sides and turrets of the ship as the available target and missing these, no results can follow. This portion of the target is the most heavily armored. On the other hand, the torpedoes from the Pneumatic gun have, primarily, the over-water hull of the vessel, involving both its deck, which is relatively large in area and weak in armoring, and the vertical target to which the high-power guns are limited. To this last, if the caliber of the gun is moderately large, serious injury may be done, directly and indirectly, while the deck, if struck, is sure to be crushed in.

But in addition to the over-water hull, it has the very great chance of doing fatal injury to the under-water hull, if missing the direct hit of the target.

No small element, in considering the effectiveness of this weapon, will doubtless be the moral effect. The knowledge that escape is not assured when the enemy's missile has failed to make a direct hit, and that the danger may even be *enhanced* by that miss, will not have a reassuring effect on the crew of the vessel attacked.

Absolute infallibility of successful action with each missile from this weapon can no more be assured, than with those from the best of modern powder guns under the most favorable circumstances. Skill and nerve on the part of the manipulator is as

requisite with this as with other war appliances. But we have seen that the *probabilities* of all attaining desired results are certainly greater than with any other torpedo appliance.

In making an attack of any kind, reliance is not usually put upon the probability of producing successful results with a single shot or torpedo. The chances are increased by increasing the number of guns used or torpedoes projected. For a given weight to be carried, or for a given amount to be expended (looking at it simply from a commercial point of view), a very much larger number of missiles can be utilized, of the Pneumatic-gun type, than of any other having any approach to relative effectiveness.

Having described the general characteristics of the gun, it may be well to consider some of the uses to which it appears to be suited.

FOR COAST DEFENCE.

On land, these guns may be considered as valuable adjuncts to the system of stationary and floating submarine mines operated from shore. Their functions here are manifold. In a very large harbor it is well-nigh impracticable to completely cover every avenue of approach by a suitable number of stationary mines. The guns should be so placed as to effectually cover such zone by their fire. In the course of action some groups of the fixed mines will be exploded either by the enemy's countermines or by the defence, when partial advances are made by the enemy. It will be impracticable to replace these exploded mines in the face of an active enemy. The Pneumatic guns, if in moderate numbers, will be able to cover by their torpedoes the avenues of approach thus otherwise left open, and shower the path of advance with their missiles.

The range of the gun—two miles—is sufficient to throw its torpedoes even beyond the distance at which the permanent lines of torpedo defences will usually be placed from the main works, which must be able to protect them or at least be able to delay the enemy's efforts to countermine. This range is fully equal to the dirigible torpedoes which some of our engineer authorities have considered necessary adjuncts to a system of permanent defences, and it is two miles greater than that of the stationary mines.

Besides as an adjunct to the torpedo defences, these guns may also be considered as a portion of the mortar armament for high-angle fire, with the advantages of greater accuracy and chances of

producing results even when missing direct hits. Their fire will be particularly useful when the enemy has approached within the outer zones covered by the mortar batteries.

There is but little difficulty in protecting these guns from the enemy's fire until they are required for use. Several designs of sunken emplacements have been made where these guns will be protected from an enemy's vertical fire, especially that of the rapid-firing guns and machine guns. These last will, I believe, form one of the principal elements of the attack on the sunken emplacements which will be largely utilized in future fortifications.

The air compressors, storage reservoirs and boilers for a group of guns can readily be protected in underground bomb-proofs.

The gun can be used advantageously on board of torpedo boats in lieu of ordinary movable torpedoes or in conjunction therewith. Some of the advantages compared with the latter have already been stated. To get in the shot at all effectively, if equipped only with the ordinary torpedo, they must approach so near that discovery is inevitable and the chances of escaping the fire of machine- and rapid-firing guns are comparatively slight.

The dangers to the torpedo boat may well be deemed to be inversely as the square of the distance, and a boat which approaches to say 352 yards (one-fifth of a mile) will have one-twenty-fifth of the chance to escape the enemy's fire, and to get in its own fire, possessed by a torpedo boat carrying Pneumatic guns capable of firing their aerial torpedo a distance of one mile.

A torpedo or cruiser to carry two 10½-inch guns and one 12½-inch gun is now building for the U. S. Government. The range of these guns will be at least one mile. The 10½-inch shell will carry 200 lbs. explosive gelatine, equivalent to 326 lbs. of dry gun-cotton. The 12½-inch shell will carry 400 lbs. of explosive gelatine, equivalent to 652 lbs. of dry gun-cotton. This boat will have a speed of at least twenty knots. While the speed of twenty knots is exceeded by the small and very light torpedo boats built abroad, it is designed to have the hull sufficiently strong.

The direction is given by steering the vessel.

The vessel will have twin screws and steam-steering gear. The arrangements will be such that the helmsman can directly control both of the engines and fire the guns.

It will be seen that this vessel is likely to be very well under control, and will be likely to prove itself a formidable war-vessel.

COUNTERMINING.

Beside the direct aggressive action against an enemy's ship, I would call special attention to the great utility of the shell for countermining an enemy's line of stationary torpedo defenses, as well as where these torpedo defenses are liable to be countermined by the enemy. Not alone will they be effective against the ground and floating mines operated from shore stations, but the operating cables are very likely to be cut and entire groups rendered innocuous; besides this, all mechanical acting mines will be destroyed within a very large radius of the countermining explosion. Officers of experience deem this ability to use for countermining a very important feature, possessed by no other appliance.

USE OF THE "PNEUMATIC GUN FOR DEFENSE OF SHIPS" AGAINST TORPEDO BOATS, DIRIGIBLE TORPEDOES AND SUBMARINE BOATS.

The present *active* defense of a man-of-war against torpedo boats is dependent on absolutely hitting a *small* and rapidly-moving object. This is somewhat difficult of attainment. With the shell from the Pneumatic gun an absolute hit is not required. The hulls of torpedo boats are so slight that a pressure of say 1000 lbs. per square inch would be enough to disable them, if not to absolutely disrupt them. A shell with one hundred pounds will effectively *stop* the approach of the enemy's torpedo boats before they can discharge their Whitehead torpedoes, even when the explosion takes place at a distance of more than sixty feet from the boat.

Again, should the enemy's torpedo boat succeed in discharging their under-water movable torpedoes (such as the Whitehead) the present armament of a man-of-war is incapable of stopping them in the least, unless the wire protective nettings are down. This is not always the case. The prompt use of a small Pneumatic gun would be effective in this direction, as its shell would burst *under* water, and have a large effective radius.

Dirigible torpedoes, such as the Lay-Haight, Patrick, Sims and Brennan, can also be stopped by this means. Besides the possibility of injury to the hulls of these torpedoes and the delicate machinery contained, all of these may be rendered innocuous by injury to the long wire on which they are dependent for manipulation and life.

A Pneumatic gun of comparatively small caliber, as readily

pointed as the rapid-firing Hotchkiss, could be designed for this purpose.

Submarine boats will doubtless be important factors in future naval operations and combats. Their presence and approach may sometimes be detected by bubbles and other indications. In the experiments already made with the Nordenfeldt Submarine Boat, it was found that its approach could be *seen* from the mast-heads, although it was so far submerged that no part of the ordinary armament of a man-of-war could have stopped it in its approach and attack. It could easily have taken up a position within 300 yards, at which distance it could discharge its Whitehead torpedoes with some approach to accuracy. But a vessel armed with Pneumatic guns could send its shell into the water over or in the vicinity of the attacking submarine boat. The explosion being regulated to take place when the shell was completely submerged, would inevitably end the career of this submarine boat.

USE AS AN ADJUNCT WHEN SHIPS ATTEMPT RAMMING.

It is held by naval officers that ships will use the ram in the course of naval combats.

Granting this, a modification of the Pneumatic gun can be introduced into a ship of such form as to be but very little in the way. In case of ramming being undertaken, it would serve as a most valuable adjunct, and might be said to be equivalent to extending the length of the ram from 500 to 800 yards. This would be done by placing in the bow of the ship a tube from forty to fifty feet in length and say sixteen to eighteen inches in diameter. The gun is placed parallel to the keel and at a permanent angle of elevation of a few degrees. The tube is fixed, the muzzle coming out at the bow a little above the water. The muzzle should, of course, be protected by a suitable movable shield. The body of the gun, especially that part in which the charge is placed, the breech, being well below the water line, is sufficiently protected. The bow, ordinarily, is very little subject to being hit. An 18-inch shell could contain about 1000 lbs. of gelatine, equivalent to 1420 lbs. of dynamite, with a pressure not exceeding 500 lbs. it could be sent at least 800 yards in advance of the ship, it being assumed that she is steering directly upon the enemy.

Should there be a direct hit of the hull of the ship above water, there can be no doubt as to the result of the detonation of

this enormous mass of explosive. This has a potential energy equivalent to 3,000,000 ft. tons, which is about fifty times as great as the muzzle energy of the 100-ton gun. The realization of a very small percentage of this potential energy would be most destructive. The additional weight demanded by adding such a tube to the armament would be small compared to the results attainable.

In this connection it may be well to note the fact that all vessels of war, of modern construction, are supplied with ice machines for direct refrigeration and air cooling.

Naval officers of experience have come to the conclusion that the class of ice machine using compressed air are, for various reasons, the best for this purpose. By a slight modification, involving but little additional weight, these ice machines may be made to produce the necessary compression of air to use with Pneumatic guns placed on such war-vessels. The compressed air could be used advantageously for steering and other auxiliary engines. Being previously stored up, it would not draw upon the supply of steam when all of the latter available might be required at critical times.

TORPEDO RAMS.

Besides various classes of torpedo boats and torpedo cruisers, England has established a class called the Torpedo Rams, the *Polyphemus* being the first of the class. Her armament consists essentially of rapid firing and machine guns and Whitehead torpedoes.

To fulfill the most important part of the work for which the *Polyphemus* is designed, implies an approach of from 300 yards down to an absolute contact with the enemy. Yet, even with these limitations, the English Government are so well satisfied with the possibilities attainable that others of this class are now being projected if not already being constructed.

A vessel as large as the *Polyphemus* could carry two 16-inch Pneumatic guns capable of throwing with accuracy charges of 700 lbs. of explosive gelatine to a range of at least one mile. This charge is equivalent to about 1100 lbs. of dry gun-cotton in efficiency, or more than eleven times the charge of the Whitehead torpedo. Considering this and the greater range and accuracy attainable, the relative value of vessels armed as the *Polyphemus* now is and as one of her class might be (with Pneumatic guns)

seems to be very much greater in the last case than the first. There is nothing to preclude the partial armament of the vessel with submerged movable torpedoes should it be deemed advisable for close-quarter work.

A vessel of about 3300 tons displacement, belonging to this type, could carry 18-inch guns, capable of throwing charges of 1000 lbs. of explosive gelatine equivalent to more than 1600 lbs. of gun-cotton. Two of these guns placed so as to fire forward, could have a range of at least one and one-fourth mile; one placed to fire astern could have a range of at least three-fourths of one mile; the other two placed so as to fire from either broadside, could attain a range of about one-half mile. The ranges of these guns differ on account of the variations in length of barrel which could be conveniently placed. It is assumed that vessels of this type are to be aggressive in character, and disposition of the guns made accordingly. The limitations as to range are also due to limitations in elevation, where the gun is retained at all times below deck. In other words, they are to be muzzle pivoting, the pivot being on the deck.

A vessel so armed could, in retreat or when maneuvering near an enemy, make its power felt, and do effective work even when assailed on all sides. The vessel would have preferably a low freeboard, presenting a small target to the enemy's fire. Her decks and sides could be quite heavily armored so as to resist the rapid-firing guns.

Specially thick shields could be so placed forward as to protect the gun-rooms when moving to attack. With this armor and full utilization of coal protection, as well as an extreme cellular subdivision of the bottom and hull, and very large pumping capacity, she might advance to the attack of the most heavily armored vessel afloat, with far greater chances of success than other torpedo boats, rams, or even larger vessels.

The speed of such a vessel should not be less than 17 knots. She should have a very large armament of rapid-firing guns and revolving cannon, so that her advance would be heralded by a stinging cloud of missiles, disconcerting the accuracy of aim of the enemy's gunners, as well as enabling an efficient defense against torpedo boats. As the function of this class of vessels would be for harbor and sea-coast defense, neither a large crew, very large quantity of general supplies, nor of coal need be carried. Hence, fully 20 per cent. of armor could be carried. Having a

low freeboard, the weight of her hull could be relatively greater, *i. e.*, more weight could be disposed of in subdividing the vessel into a very large number of cellular compartments.

Owing to the unknown character of the Pneumatic gun, its possibilities are not generally recognized, and many professional men have been loth to accept it as a practical appliance of war. It is considered by many as a species of quack medicine, as a toy —a pop-gun. I have therefore been constrained to argue the case, in laying before you my views as to its applicability, basing my arguments chiefly on accomplished facts. I regret that so much of your time has been occupied, and trust you will pardon me for having trespassed upon your patience.

The gun is generally spoken of as Zalinski's gun and as being my invention. This I have deprecated and repeatedly denied. I claim, however, that I have given direction to its development as a practical military appliance indicating in a general way the requirements to make it such. I am not a mechanical engineer and could not have properly worked out the mechanical details and design unassisted. This has been done by Mechanical Engineer, Mr. Nat. W. Pratt, of the Babcock & Wilcox Co., and Mechanical Engineer of the Pneumatic Dynamite Gun Company, who has very ably worked out many difficult mechanical problems involved in the work. Mr. Geo. W. Reynolds and Mr. Chas. Emory, both distinguished in their profession, have aided very materially in bringing about the sum total of that measure of success attained.

The electrical fuse, alone, I claim as my personal invention. But in its development I have received very material assistance from others. In the matter of choice and character of battery to be used as well as otherwise, Dr. Charles Waite, of New York, Capt. Willard Candee, and Mr. Barrett, both of Brooklyn, have aided me. In the evolution of the practical details, of construction of the fuses and general arrangement, I am very much indebted to my able and zealous assistants, Messrs. Henry P. Merriam and Birnie C. Batcheller. Mr. H. Julius Smith has given me very material and important assistance in the adaptation of low tension electrical primers to the requirements of this special work. I have found the primers made by him for me marvelously uniform and reliable in character.

I have pushed this work on as vigorously as I could, because, aside from the professional interest involved, I saw in it possibili-

ties of usefulness in cases of public emergencies, which may arise even now, before a regular modern armament could be provided.

Whilst I have never considered it as all sufficient for defensive purposes, I have thought it a very valuable auxiliary in any event. But most of all, if attacked before modern Guns, Ships and Forts are provided, we could at least very seriously injure any attacking force, before being ourselves destroyed. Our sting will be felt, and an attack will not be made with absolute impunity. The power that we have to inflict *some* injury, will not be without weight in considering the advisability of attacking us.

It is both my duty and a pleasure to acknowledge the cordial and earnest support and advice given me by my immediate superior and Commanding Officer, Colonel John Hamilton, 5th U. S. Artillery. This was accorded me by him from the very inception of the experiments. Had this not have been the case, the experiments, if carried on at all, would have dragged along without eventuating in tangible results.

Having seen the gun brought to a point of assured practical success, it is now my purpose to let others continue the work. I desire to turn my attention and studies in the direction of professional matters of a wider scope. I do not care to be and remain simply a "Dynamiter."

DISCUSSION.

COLONEL HAMILTON :—I do not believe that high-explosives will ever be successfully propelled by gunpowder.

In this I do not say that useful high pressures may not be accumulated from gunpowder or other substances, besides compressed air. I believe that Lieut. Zalinski and others are having this matter in consideration.

But for a full gunpowder explosion, that will produce the initial velocity desired by those who sneer at the aerial torpedo, you would have to overcome what now seems to be impossible. The necessary cushioning eats up your motive force, increases the strain on the gun, and is yet far from being proved safe. The thickness of your case to resist the force of gunpowder gives you iron instead of nitrogen.

Suppose it possible to get 30 lbs. of dynamite into a "flat trajectoried shell"; it is but thirty pounds, and a large portion of its force is used up in bursting the shell. If you only wish to attack an enemy with *case-shot*, probably dynamite would break your shell into smaller pieces than gunpowder would. But how can you make a *torpedo* out of any proposed gunpowder-thrown shell? What important amount of explosive can it carry?

As to the value of torpedoes, there appears to be a difference of opinion among high authorities. General Abbot says they will smash a ship; some naval officers

say they won't hurt a decent iron-clad. If they will not from Zalinski's gun, why bother with guns that will only carry from 15 to a maximum of 30 lbs. of explosive?

Again, I don't believe that high explosives will ever be safely thrown from a *rifled* projector.

Whatever be your motor, condensed air or gunpowder, a violent longitudinal vibration is set up in the gun, which alternately contracts and expands the tube in accordance with the musical note of the system; this correspondingly clamps and frees the missile, so that it progresses through the tube *chatteringly;* and in doing so, it sets up the very dangerous synchronous vibrations that shake the atoms free from their molecular attractions, and this is still increased by the heating up of the charge by this *tremolo* separating the atoms beyond their attractive limit.

There can be no doubt of this mode of motion of a projectile in a tight tube. I have seen the annuli of compression and expansion beautifully brought out in a bursted rifle, which had been exposed to a night's dew, in a highly ozonized atmosphere.

If suddenly heated nitrogens will blow up a ship, it strikes me that Zalinski's way of getting them there is the best of the mobiles yet proposed.

BATTLE OF WATERLOO.

(From a German Standpoint.)

By FIRST LIEUT. J. J. O'CONNELL, U. S. A.

THE battle of Waterloo, or as Charras aptly calls it, "The Legend of St. Helena"—the most remarkable of the century, had not until recently been duly estimated. Many authors, French, German and English, have vied with one another in producing voluminous works on the subject, yet one-sided and therefore inaccurate, shedding so little light that truth was unable to break the Web of the Legend, until in recent times the efforts of Königer, Charras, Pierot and Chesney, in bringing to light the unvarnished and unfalsified facts, have been crowned with success. We beg our readers to follow us in the company of the above worthy authorities, while we recall the events of the day that saw the destruction of the earthly power of the mighty Napoleon. The Emperor left the Island of Elbe on the 26th of February, 1815, to return to France. He landed near Cannes on the 1st of March and reached Fontainebleau on the 20th. Louis XVIII. quitted Paris on the previous night, and Napoleon again took possession of the Tuilleries. Eight nations—among them Prussia, Austria, Russia and England—had already, on the 13th of March, proclaimed Napoleon an outlaw, and delivered him, as the disturber of the peace of Europe, over to public pursuit and punishment. This was a declaration of war against the person of the Emperor. The powers that established King Louis on the throne of France, assumed that he could, with his army, succeed in maintaining the peace of the Kingdom, but soon this hope proved a delusion. Napoleon, with his constantly increasing adherents, was soon able to draw the whole Kingdom from its allegiance to its legitimate Sovereign. The fighting Emperor now began with feverish zeal to place his army in a condition equal to that which he knew his enemy's had attained. It would be foreign to our

purpose to inquire into the reasons why the opening of the war was so long postponed, although the greater part of the Allied Army stood ready near the French frontier, and why an immediate strategic advance was so long delayed. King Frederick William III. ordered Prince Blücher, on the 30th of March, to rejoin the Army and take chief command of it. Marshal "Forwards" quitted home on the 10th of April, and was received by Gen. Gneisenau and staff on the 19th, at Liege. Wellington transmitted, on the 12th, a plan of operations to Vienna where the potentates of Europe were assembled in Council. This plan very properly embraced as its chief feature the necessity of circumventing Napoleon's operations by celerity of action on the part of the Allies, yet the High Council thought proper to ignore this important point and to order that active operations should not begin before the 1st of June—probably because in its opinion the necessary preparations could not be effected before that date. Even this was not adhered to; the 27th of June was finally decided upon for offensive action according to the proposition and fixed determination of Prince Schwarzenberg. The warrior Emperor was not guilty of similar procrastination. Although he experienced the greatest difficulty in assembling a numerous and efficient force, he recognized too well that the advantage of the initiative is often incalculable. As soon as Napoleon had mustered 128,000 men, and partly schooled them in only the most indispensable requirements of War Service, he resolved to seek an immediate decision by the sword. The Prussians on the Belgian frontier numbered 116,000, the English and Dutch, excluding garrison troops, 94,000. Napoleon left Paris on the 12th of June, having organized a provisional government to act in his absence, at the head of which he placed his brother Joseph. He reached Avesnes on the 13th and entered Beaumont on the following day, when he issued orders for the advance of his Army on Charleroi. This was the first act of the campaign. Notwithstanding this somewhat delayed advance, occasioned probably by Marshal Ney's fault, the Emperor surprised the Prussian Army, the concentration of which had not been quite completed. Having crossed the Sambre he advanced on Fleurus, with the avowed purpose of preventing the union of Blücher and Wellington, the latter of whom Ney was to hold fast at Quatrebras. Blücher, always the advocate of vigorous measures, confronted him at Ligny with three corps, viz.: those of Zieten, Pirch and Theilmann; unfortunately the 4th corps, Bulow's,

was absent. Here a bloody battle was fought. The action began about 2 P. M. and lasted until late in the evening. After a most obstinate struggle, during which Marshal Blücher was in imminent danger of losing his life, the Prussians were forced to retire on the Wavre, leaving Napoleon in possession of the battle-field. The French did not immediately pursue the retreating Army, so that Blücher halted next morning, and was enabled to collect and re-organize his army.

On the same day, the 16th of June, Ney attacked Wellington at Quatrebras. The latter's advance had been delayed by several circumstances, so that he was compelled to meet Ney's attack with his army in a somewhat scattered condition, but after the first onset, the concentrated Anglo-Dutch forces faced the enemy with superior numbers, and Ney, after 9 hours of desperate fighting, was forced back on Fresnes. Napoleon, on the 17th, dispatched Gen. Grouchy in the wrong direction, *via* Namur, in command of 33,000 men in pursuit of Blücher, and recalled Ney's troops from Fresnes to the main body, while Wellington took position on Mount St. Jean, where he expected to be joined by Blücher, and awaited Napoleon's attack. This was the condition of affairs on the 17th of June. Although Blücher was forced to retreat as a consequence of the battle of Ligny, yet he sent a written promise to Wellington on the 17th, that he would not only send him one corps on the 18th, but two, and would be with him himself with his whole Army if possible. Thus supported, the English chief confidently awaited the impending battle. The 18th of June fell on Sunday. It rained heavily the previous night. The rain ceased at 6 A. M. of the 18th, however; the sky remained clouded. The ground was wet and muddy, yet artillery officers declared that cannon could be moved over it about 9 A. M. Napoleon, who feared in the morning that the English would abandon their position, betook himself about 9 A. M. to the farm-house of Rossomme, where he had an extensive view of the enemy's position and the country south of it. Observing that Mount St. Jean commanded a good view of the country in its vicinity, he resolved to strike the Allied Army with terror by the deployment of his forces in battle array in full view before it. He therefore ordered his whole Army formed into eleven columns, to march in line of battle from their bivouacs on the right and left of the Brussels road, from Frichemont *via* Belle-Alliance to the Nevelles road, and opposite the Castle of Hougomont. The order was executed with

great tactical ability, and the Emperor, in recalling at St. Helena the accuracy of details in the execution of this beautiful review was filled with enthusiasm as he said, "The spectacle was magnificent, and the enemy, who were so situated as to be able to see even the last man, ought to have been struck by it." Wellington had chosen his defensive position on the plateau of Mount St. Jean about 8 A. M. His choice has been considered a good one, with the exception that it lacked in depth, but this advantage was equalized by the immovable firmness and endurance of the veteran English troops. The military pageant that was intended to strike the Allied Army with terror and admiration terminated about 10.30 A. M. in the formation of three lines of battle. According to the most reliable authorities of recent times, Lord Wellington's Army consisted of 67,600 men, divided as follows: 49,000 infantry, 12,400 cavalry, 156 pieces of artillery, and about 5,600 non-combatants. Opposed to these Napoleon had 72,000, viz.: 48,900 infantry, 15,000 cavalry, 246 cannon and about 7,000 non-combatants. Napoleon was stronger in cavalry and artillery than his opponent, and his infantry consisted for the most part of veterans, while that of the Anglo-Dutch Army, according to the best authority, could only count upon about two-thirds of its number as such. Napoleon gave the order to attack, about 11.30 A. M. His reason for delaying the action until that hour is not clearly accounted for. The whole manner of this beau ideal of a soldier and commander, on the morning of the 18th, was that of a man perfectly confident of the success of his measures. He felt, as it were, a foretaste of victory, and although observing the firm attitude of the enemy, yet he allowed no trace of fear to enter his mind that a mishap might happen, such as the sudden appearance of a fresh army on his right flank. But why did he postpone until that late hour a battle for which he had so energetically prepared in the early morning? Was it not perhaps on account of a certain undefined feeling of dread, of foreboding, of reluctance to confront fate in what must be a decisive battle?

He opened the battle with a vigorous cannonade, under the cover of which he ordered Reille's Corps to take possession of the park and chateau of Hougomont. A part of Guillemont's Division began its movement northward at the same moment that 70 pieces of artillery in position west of the Brussels road opened fire, the movement being supported by a flank fire along the whole line of battle. It took possession of the Park of Hou-

gomont, while the English held possession of the outhouses and chateau, which they continued obstinately to defend. The French soon needed and received re-enforcements. The troops in the advanced line of the English right wing were likewise re-enforced by the Brunswickers, who were detached for that purpose from the reserves. Napoleon now decided to make a powerful infantry attack on the enemy's center, and confided the execution of the movement to the bravest of his Marshals—Ney. Before the necessary dispositions for this attack were completed, Napoleon observed troops on the heights of St. Lambert, whom he recognized to be Prussians, but announced as a part of Grouchy's detached corps. The approach of this new force diverted his attention from the proposed attack, which was therefore delayed by the necessity of taking immediate measures in relation to this unexpected danger. It was half-past one when Ney advanced to the attack with Erlon's Corps deployed in columns of divisions. The four strong columns which advanced, successively attacked with great determination and gained the crest of the English position. Battalions of the Allies came hastily to the rescue, assailing the French in flank and rear, causing them to halt, to waver, and finally to retire. Lord Wellington profited by the opportunity and pursued the retiring enemy with cavalry, in which the Greys and Inniskillens were conspicuous, having completely destroyed two French batteries. The cavalry in the heat of the conflict pursued the enemy too far, fell into disorder, and being attacked by Milhaud's Cuirassier Brigade, suffered very severely until rescued by a brigade of English and Dutch horse. In the meantime the brigade of the first column of division that attacked La Haye Sainte, was repulsed with loss, and the cavalry combat there also ended to the disadvantage of the French. Simultaneous with the attack of Erlon's Corps on Wellington's center and right wing, Reille's Corps attacked his left with no greater success, although the two divisions of Fay and Guillemont were repeatedly hurled against it and suffered great losses. Napoleon now becoming more uneasy at the appearance of the Prussians at St. Lambert, in order to protect his right flank ordered the cavalry brigades of Dumont and Subervic to proceed in that direction against them. The Prussians, however, continued to advance through the Bois de Paris, which had been left unoccupied, and not having been held at bay nor pressed back by the French cavalry, Napoleon still found himself

compelled about 4 P.M. to send Lobau's Corps to oppose them. This Corps marched some hundred paces to the east of Frichemont to meet the fourth Prussian Corps under Bülow, which soon came within striking distance. It was half-past four when the first cannon was heard on this part of the field. Now that the Prussians were becoming an important factor in the problem, Napoleon had the choice between retreat and the renewal of his attack on Wellington. He chose the latter, hoping still to vanquish the latter before the full effect of the Prussians was felt, and made his preparations accordingly. Ney's urgent appeal for re-enforcements was for the moment disregarded, and finding that he would have to depend on the cavalry, he ordered Milhaud's Cuirassiers and the light cavalry of the Guard to advance between Hougomont and La Haye Sainte. The gallant riders threw themselves upon the artillery and solid squares of the English, and charged them with the greatest impetuosity, penetrating even to the second line of battle, but they did not succeed in breaking even a square, and were compelled to retire. They charged again and again, every squadron of Milhaud's horse, the Lancers and Chasseurs were repeatedly hurled at the squares, but in vain, notwithstanding their reckless gallantry and sublime devotion. About 5 P. M. Napoleon was obliged to order Kellerman's Cuirassier division of the heavy cavalry of the Guard to the assistance of the indefatigable Ney, who performed real wonders of bravery, in his efforts to silence the artillery and break the English squares. The repeated attacks failed to break the line of battle and to overcome the stubborn opposition of the English infantry, but succeeded in capturing, by storm, Hougomont, except the castle, and La Haye Sainte.

As soon as the Prussians had reached the edge of the Bois de Paris, about 5 P. M., the battle in this part of the field assumed a more important character. Napoleon was now forced to use all his available troops to not only protect his right flank but also his rear from this imminent danger. To this end he ordered 8 battalions and 24 cannon to the support of Lobau's Corps at Plancenoit and Morand's Division of the Old Guard—trusty troops —to hold themselves in readiness as reserves. A desperate conflict now raged about this important village, which was finally taken by Hiller's Brigade, of Bülow's Corps, about 6 P. M., after a long and wavering contest, but was recaptured by the French, who succeeded in driving out the Prussians, with the assistance

of Morand's Division, and this was effected only after the greatest exertions and through heavy losses on both sides. When Napoleon saw Steinmitz's Brigade of the First Prussian Corps arrive, about 6 P. M., in close proximity to Wellington's left, he felt that the decisive moment had come to mass, according to his old tactics, all the available force that yet remained against the center of the enemy's position, and to break it, before it was strengthened by the Prussians. The bellicose Emperor was fully impressed that his last chance had come. He again trusted his battle-tried friend, Marshal Ney—the bravest of the brave—with the execution of his plans, well knowing that he, too, was fully aware of how matters stood, and was alive to the importance of the moment. He gave Ney 6 of the remaining 10 battalions of the Old Guard—élite and unbroken troops—as a nucleus, about which the shattered remnants of the Corps of Reille and Erlon were to be rallied, to make the last and supreme effort to break the strong position of the enemy's center. Marshal Ney made his preparations, divided his force into 3 columns, and led them between Hougomont and La Haye Sainte. Sword in hand, he encouraged his men by word and example, leading the attacking party himself. He succeeded in reaching the crest of the oft and vigorously contested position. The French now gained some advantage, for they threw their opponents into disorder, and in several places even drove them back. However, every step of the advance was stubbornly contested, and finally brought to a halt. The brave troops of England, Holland, Brunswick and Nassau, although forced back, still presented a continued and formidable resistance to the victoriously advancing French, until Zieten's Corps had fully deployed on their left, where it, with fresh vigor, took part in the battle, and then the victorious right wing of the French, which had taken Papelotte and La Haye, was checked for the moment. Slowly, but inexorably, the tide of victory turned from the French. The backward movement of the Allies, who were now encouraged and strengthened by the Prussians, was stopped, and Wellington soon was enabled to take the offensive. The French now were forced to retire, and Ney's desperate and last effort failed. By degrees the effect of the Prussian re-enforcements extended to all parts of the French Army, even Napoleon's Old Guard, notwithstanding their obstinate determination to the contrary, were forced to retire. Almost at the same time that Ney was worsted in his last attempt

on the English center, the French were driven out of Plancenoit by Bülow's Corps, aided by that of Birch, who had arrived just in time to take part in the action. The 12 battalions of the Guard and the whole of Lobau's Corps were driven from the field, but only after they had sustained the heaviest losses, and joined in the general, and at first, in part, orderly retreat, which set out from the heights of the English position and turned toward the Genappe road.

That the battle was lost, Napoleon saw full well; yet all was not lost, he had yet remaining 4 battalions of the Old Guard. These he posted on the right and left flank, toward La Belle Alliance and La Haye Sainte, to stem the torrent of the retreating masses, and to rally them into a firm and orderly body. Ney worked indefatigably to bring order out of the chaos that surrounded him. The confusion and disorder rapidly increased, and the retreat was fast assuming the character of a flight. The result of the universal despondency on the part of the French manifested itself in an increasing degree, the more the active participation of the Prussians now made itself felt. Marshal Blücher appeared on the field, and, being always enterprising and aggressive, now that his forces were fresh and numerous, he formed them on the right flank of the enemy. Even Wellington ordered in pursuit the few that were yet serviceable of his terribly cut-up troops, and both commanders met for the first time that day at Belle Alliance, where they embraced each other with much emotion. Napoleon concentrated his newly rallied force, which was fiercely beset on all sides at Rossomme, where he, that very morning, first issued orders for the opening of the battle. But this, his last organized resistance to the now overwhelmingly superior forces of his implacable enemies, was speedily broken. A wild despair seemed now to take possession of him, as he saw all about him giving way, and even his Old Guard forsaking him. "Sauve qui peut" now became the order of the hour, and the French Army, with the approach of darkness and the spirited pursuit of the Prussians, was dissolved into isolated and disorganized groups, until finally soldiers, officers, generals and Emperor, all fled in a disorganized mass from the field. Such was the battle of the 18th of June, 1815, called by the English "Waterloo," by the French "Mont St. Jean," and by the Prussians, in accordance with the wishes of Blücher, "La Belle Alliance." The historical presentation of this battle experienced

more changes in the first 70 years after it was fought than almost any other military event in history. The present accepted account of it leads to quite a different result than what has been given by the early English, French and German writers. It is now universally admitted by the best authorities that Napoleon committed a grave error not in attacking Wellington, but in beginning the action too late in the day, and in dividing his army before the battle was fought. These facts are indisputable.

In the present light of history British Chauvinists must surrender their position in regard to this battle, for even English historians acknowledge that the brilliant victory is not alone due to the courage, firmness and endurance of the English infantry, but likewise, and more especially, to the vigorous and well-timed participation of the Prussians, under the personal command of Blucher. To correctly estimate the view taken of this battle by the average Englishman, the perusal of the following extract, taken from the 18th edition of an English school history, will suffice:

"The head of the Prussian column was seen approaching as night came on, to take part in the battle. It being comparatively fresh, undertook the pursuit (the French are represented completely beaten by Wellington), and the French Army ceased to exist."

It may here be asked how any Englishman could arrive at the following facts of the case from reading the above extract, viz.: that the bravest commander of modern times, Marshal Blücher, had actually taken part in the battle with a part of his Army a little after 4 P. M.; that he fought a desperate battle with Napoleon's Army during three hours: that he had not less than 50,000 men engaged in the battle, and that fully a seventh of them, 7,000, lay dead and wounded on the memorable field. Fortunately, history, though often late, usually corrects itself, and in this particular it is pleasant to note that not only French, but likewise English historians have lately made every effort to render clear the dark and doubtful episodes in this battle and to give due credit where it belongs. The statement that Field-Marshal Blücher was in danger of his life at Ligny, and his delivery therefrom, has been veiled in a great deal of mystery, and the facts of the case are not generally understood. It may be here noted, what has on a former occasion been stated in the *Universal Military Gazette*, that the saving the life of Blücher on the 16th of June was

less due to his Adjutant, Count Rostiz, than to Lieut.-Gen. Freihern von der Busche. The latter died at Halden in 1869, and went through the campaign of 1815 as a captain of cavalry. I will here reproduce the facts in the case taken from a public lecture of Freihern Baldwin von Schule, and published in the *Military Gazette*, of 1870. These details Von Schule had from Von der Busche in person. "After having waited a long time about Haye and Namur, we received orders on the 15th to break camp, and co-operated on the 16th in the battle of Ligny, where, alas, I lost many of my brave comrades, but also had the good fortune to do something in helping to save the life of Prince Blücher who lay under his dead horse, inasmuch as by my assistance he was saved from death or capture. When the Prince had again mounted, after being extricated from his horse, he and his only companion, Count Rostiz, were about moving to the left; by flying in this direction he would most probably be taken prisoner. I advised him to turn to the right in the direction of Sombref, where he would find General Thielmann's corps. When I saw him out of danger I hastened back to my squadron who were reforming after having taken part in the general cavalry charge. Count Rostiz is greatly praised and highly extolled for saving the life of the Prince, yet he could confess to himself, that beyond an answering constancy to the Prince while in imminent danger, he did nothing to save his life. It may be that he was stunned like the Prince, the latter from a fall, the former from terror; however, he merely sat quietly on his horse. I would not mention these facts if I thought they would obtain publicity before the Count's death, for according to the probable course of events I shall survive him. I have mentioned them only to a few friends, and merely because I felt aggrieved that I have never been mentioned in connection with saving the Prince's life on this particular occasion, in which by a mere chance of good luck I was able to render some service. I have never received a friendly word on account of it, much less the special distinction which the Count wrote me (which letter I hold in my possession) that the Prince would ask the King for me--the Iron Cross I received on the demand of my regimental commander. In a word, I would not have mentioned these matters, had it not been perfectly clear to me that Count Rostiz never mentioned me in relation to this subject, in order that the fame which he acquired in this connection may not be detracted from.

I have not made these things public because I did not wish to render my life more embittered than it was."

We forbear to go further into this matter, suffice it to say that the above extract having been published in the press eleven years ago, the facts therein contained have never been contradicted. We may therefore reasonably conclude that Count Rostiz was not the only one instrumental in saving the life of Blücher on the 16th, at Ligny. Besides the universal "Sauve qui peut" which was heard on all sides, after the last effort of Napoleon had failed, and his gallant Old Guard was shattered to pieces, another battle-cry is supposed to have been uttered at Waterloo by General Cambronne, viz.: the famous cry of Napoleon's Guard—"La Guarde meurt, elle ne se rend pas"—the Guard dies, it does not surrender. This is a matter that has also been veiled in fiction. Cambronne is represented by French, and even by German writers, during the late evening fight of the 18th of June, as using this expression at the head of the Old Guard when asked to surrender. The sons of Major-General Michel have lately come forward and claimed the honor of this response for their father who bore a conspicuous part in that bloody battle. It is now a matter for investigation whether Cambronne or Michel really used these words, or whether the story does not rest on mere rumor or on picture-painting imagination. Thiers and Victor Hugo ascribe the words to Cambronne. The city of Nantes, in 1845, erected a monument to the memory of Cambronne, at St. Sebastian, where he was born, with the intention of placing the famous motto as an inscription on it. The sons of General Michel objected to the latter, on the ground that their father, who was killed at Waterloo, was the original author of it. They fortified their claim by the introduction of Col. Count Gustave de Pontecoulant's history of the battle, which confirmed their position, and by exhibiting a slab taken from the grave of Napoleon at St. Helena, on which General Bertrand had placed the following touching inscription: "Dedicated to the Baroness Michel, widow of General Michel, killed at Waterloo, where he gallantly answered the demand to surrender with the glorious exclamation, "The Guard dies, it does not surrender!" The writer does not know the result of the action taken by the heirs of General Michel in reference to the claim. It is not impossible that the filial devotion of the sons originated it, yet I have not read anything to justify this view, though I have closely paid attention to the public press in relation to this claim. It is

pretty well determined that Cambronne never used the words. Numbers 33 and 39 of the *Universal Military Gazette*, of 1875 (published in Berlin), contain two articles on the authorship of the famous battle-cry of Waterloo. It is therein shown by Colonel Walden, of the Royal Hanoverian Contingent, that the statement —"Cambronne used the words generally ascribed to him and remained wounded on the battle-field until he was removed later on"—is entirely false, since the said general was taken prisoner by the Hanoverian Col. Hackett, in person, on the 18th of June. Col. Walden refers to Col. Dehnel's work on the battle of Waterloo (which is compiled from the accounts of eye-witnesses), viz.: "Reminiscences of German Officers in the British Service, from 1805 to 1816," printed in Hanover, 1864. The work gives the minutest details on the matter in question, and the following is an extract from it, which was dictated by General Halkett to Colonel Dehnel, and afterward signed by the former: "The Hanoverian infantry brigade, commanded by me in the battle of Waterloo, consisting of the battalions of Osnabrück, Salzgüter, Bremervörde and Quakenbrück, was with other troops employed in defending the garden around the Castle of Hougomont. We had a very hot time of it. After the last and completely unsuccessful attack of the Imperial Guard on the English position, I received orders to advance with Colonel Adams' English Brigade. At that moment I had only the Osnabrück battalion with me, the rest of my brigade was still among the hedges in the garden of Hougomont. I advanced with this battalion, and directed my Adjutant, Captain August von Saffe, of the 1st battalion of the Line of the German Legion, to find the other battalions of my brigade and to order them to join me promptly. While we were advancing, Captain von Saffe was killed, before he could communicate my orders. Hence the three battalions of my brigade did not join me. In the meantime, Colonel Adams' brigade and my battalion arrived in close proximity of three battalions of Napoleon's Old Guard. We received their fire which we returned with interest while advancing on them. They about faced and retreated. We followed. They again faced us and fired, for which we did not remain long indebted. We had now approached within two hundred paces of the old soldiers of the French Emperor. I repeatedly cried out to them, "Rendez-vous, mes amis." I indeed heard some words in reply but could not distinguish them. The enemy continued to retreat. Their commanding officer, who was mounted, en-

deavored, but in vain, to bring his horse to a halt. When I saw him again, he was on foot between two aide-de-camps, having lost his horse, and about 150 paces in rear of his column. I instantly determined to attack him in person. I spurred my horse and rode down upon him, threatening him with uplifted sword. He immediately threw away his sword and cried, "Je me rend!" He gave me to understand that he was General Cambronne. While conducting him to our lines, my horse, which had already been wounded, was struck by a bullet and fell to the ground. In the act of extricating myself from horse and saddle, the remarkably strong animal sprang up with me on his back. While this was going on my prisoner attempted to escape. I dashed after him, seized him by his aiguillettes, brought him to our troops and handed him over to a sergeant. Immediately after this event, the Osnabrück battalion took many French prisoners, after which it followed in pursuit the deep and disorderly masses of the flying French to the suburbs of Genappe, where we allowed a column of Prussian cavalry, who were in hot pursuit of the French, to precede us. We then took possession of some houses, in which we remained the rest of the night among wounded French soldiers. Colonel Dehnel's history of the battle of Waterloo bears the stamp of truth and may be implicitly relied on. It appears, then, that the utterance of this famous expression by Cambronne is pure fiction, and it is very questionable whether it ever was uttered at the battle of Waterloo.

CORRESPONDENCE.

PROFESSOR MICHIE
ON THE PERSONNEL OF THE ARTILLERY.

TO call this "energetic" would but faintly describe it. The question is as to the correctness of the assertions. Are they true? If not, a great wrong has been done the Arm. If so, then some one has blundered, and something should be done to remedy matters; for, in that case, it is evident that the Government is not receiving adequate return for the money expended on this arm of Service. In any event, however, the thanks of the Artillery are due to the Professor for the evidently friendly tone he has assumed toward it. It is pleasant to find an outsider who is willing to give us credit for good intentions even; hence, we all the more appreciate it in this instance.

One reason why Artillery officers of lower grades are so apathetic is because promotion is so slow. The rank of Captain has a peculiar importance in our Army. Chaplains, store-keepers, doctors, after four years; ordnance and engineer-lieutenants, after fourteen years, and all other Staff appointees (Signal Service is not noticed) upon entering service, have, at least, the rank of Captain.

In the Staff, an officer is helped along until he becomes a captain. He is not permitted to rest without Legislative help, until he has attained to that rank. In the Line of the Army it is different. There every man works his way up from the bottom; and, as there is no examination before promotion, the blockhead moves as fast as the most talented.

The greater the number of lieutenants in any arm or department, compared with the number of officers therein above them, the less are the chances of the former for promotion into the higher grades. The proportion of lieutenants to those above them is thirty-five per cent. greater in the Artillery than in the Infantry; fifty per cent. greater than in the Cavalry; four hundred and sixty per cent. greater than in the Engineers; five hundred and forty per cent. greater than in the Ordnance department. This shows at what a disadvantage lieutenants of artillery are placed, compared with all others, in attaining to higher grades.

Some artillery lieutenants on the active list could, to-day, be turned out of their quarters by officers of other arms, who were born after the former entered the military Service. It lies wholly within the range of possibilities for the son of a lieutenant of artillery to enter either the medical, the commissary, or the quartermaster department, or the list of store-keepers, and not only turn his father out of quarters, but take precedence of him on boards, courts, or other duty (except command of troops), where they happen to be associated in Service.

These are facts. Does the Professor wonder, or does anybody else wonder that officers should become, under this intolerable load, "listless, depressed and cynical." To expect any other result, would be to give them credit for being more than human. If, under these circumstances, a lieutenant of artillery retains any love for his profession until he is a captain, which now happens when he is in the vicinity of fifty years of age, it is because of the inherent worth of the man, and in spite of adversity, which could only be expected to crush him.

The Professor remarks with eloquence: "No foreign Service possesses a body of officers so unspotted in honor and integrity, in general, so capable in intellectual and scientific ability, or so single-minded in devotion to their profession, as those who grace the rolls of the Artillery of the United States Army." That is a glowing tribute to any body of men! None could wish for more than perfect assurance that it was not too generous! Yet, hard lines indeed is it that those of whom these words are written, have no hope except to spend the best years of life, until past meridian vigor, in the ranks of the subaltern. Touching plans of melioration, the Professor is assured that, no matter which be adopted, it must result in raising this class of officers out of the depths into which they have been plunged, and which shuts out every ray of hope for timely advancement. Theorize as much as you will, the instant that the *military spirit* departs, an officer is but a piece of clay; and if anything short of dishonor is calculated to crush out that spirit, it is being held in a vise, and not permitted to rise in the world.

From the report of the Fortification Board (which, by the way, had not an artillery officer on it!) it seems that the twenty-seven most important sea-coast fortifications will require for their armament 1305 heavy guns. The minor places will require 1428 guns. If these points are to be at any time garrisoned with men enough to maneuver the pieces, it will require 75,000 men to do it. If three years will be required to turn out these heavy guns complete, it may be easily understood that a still longer time will be required to prepare the personnel for managing them with effect. Those among experienced soldiers, who will assert that artillerymen can be improvised are few, if any. The facts of history do not sustain them.

One of the most singular phenomena germane to this subject of sea-coast defenders that late years have presented is the composition of the Fortification Boards. If the layman were asked who should be prominently represented on these Boards, he would probably say the Artillery. Why? Because, as that arm will man the fortifications and uphold the honor of the flag when the enemy assails, it seems but natural that its offi-

cers should have a voice and influence in the counsels which pre-determine the system of defense. Instead of this, however, engineers, ordnance officers, navy officers and civilians, anybody, in fact, *except* artillery officers, are placed in these positions. A studied effort is made to exclude them from the places of importance which, if they are competent for their duties, they should be first called to fill. Except some of the engineers, not one person who, in recent years, has graced the list of Fortification Board personnel, would hear a hostile shot fired if the coast were attacked tomorrow. What other than a benumbing effect can this have on the professional spirit of the arm which is thus proscribed? They are good enough to be intrusted with the defense; when the foe is to be beaten back they are called on to do it; the honor of the Nation is intrusted to their professional knowledge and their valor; yet, almost surpassing belief, these same officers are studiously excluded from the counsels which would best fit them for this work. If a foreign officer of intelligence were told this he would scarcely credit it, because nothing like it is seen elsewhere. It is repugnant alike to professional practice and to common sense. It is pretense of the worst kind, and simply shows that the Government is devoid of any thing worthy the name of Military Policy, and in truth we are only military quacks.

The artillerists of other Services are scientific corps. Not so with ours. As artillerists we are mere gunners. We have some scientific knowledge, but it is not needed for the present duties of the artillery officer. Is this denied? How can it be, when all know that there are officers going right along toward the head of the list who have no sort of pretense to scientific knowledge? When we are not gunners we are red-legged infantry. It is hard to acknowledge this; it makes us wince to do it; but it is the fact. It is necessary to understand the fact, also, because the first step toward reorganization is a first appreciation of the existing state of affairs and the evils attending it.

We may as well understand first as last that the Artillery cannot be reorganized without hurting somebody. "Omelets cannot be made without the breaking of eggs." Whoever will be hurt will oppose re-organization. No one can blame them for this. It takes more virtue than we have any right to look for in men to expect them, without a murmur, to be sacrificed on the altar of their country.

Re-organization with a view to enhanced efficiency means lopping off the dead wood to vivify the tree. If, however, we are in earnest, this will not be an insuperable obstacle, for in this matter public should take precedence of private interests. And let us say, in our opinion this whole question of artillery re-organization is one of personal and private interests *versus* the public weal. If there were not personal and private interests jeopardized it would be a simple matter.

At to the duties that should devolve upon the new artillery, the Professor remarks: "This branch of the military profession is essentially and peculiarly scientific in its fundamental requirements. The professional knowledge of the modern artillerist must embrace the theory of gun construction, the composition and analysis of powders, the material and form

of the heavy rifled projectiles, the construction of the heavy yet easily-moved gun carriage, with its intricate mechanical appliances for pointing and maneuvering; the qualities, methods of assembly, strength and resisting capacity of armored plating for forts and ships; the theory of interior and exterior ballistics; and the theory of gun strains, air resistance, energy, etc. This theoretical knowledge must be accompanied and confirmed by experimental trials with all the newly-devised armaments at properly equipped proving grounds: by observing and noting defects and devising remedial measures; by actually commanding, drilling and exercising gun detachments as in actual engagements; by learning the defensive strength and capabilities of the various fortified places, the characteristics of each harbor and channel, and the possible locations and positions of attacking vessels; and by locating and managing lines of torpedoes. As a future commander, the artillerist must be instructed in the principles relating to the organization, strength and care of a garrison; and in the many details concerning the supplies, ammunition, etc., required for an active defense. The devotion of a life-time is needed to thoroughly master the many subjects which must of necessity engage his attention from the time of his admission as a junior officer until he becomes superannuated.

"It will be noted that the sound knowledge of his art requires a previous knowledge of the principles of mechanics, chemistry, metallurgy, electricity and other branches of physics, and these demand for their mastery a fair aptitude for mathematics and a knowledge of mathematical processes.

"A due consideration of these essential requisites leads me to the conclusion that the best possible organization for the artillery of the U. S. Army is that of a scientific corps, somewhat similar to the present Corps of Engineers. With such an organization the Artillery in particular and the Service in general gains in every essential and is deprived of nothing that is of any value."

Some of these duties now appertain to the artillery but none that are of a scientific nature. The latter all belong to the Engineers and the Ordnance; the Engineers having filed a caveat on all knowledge appertaining to the management of torpedoes, while both gun construction and gun proving are treated as the especial secrets of the ordnance department.

It would be unwise for two arms of Service to be assigned the same duties. If the Professor be right the Ordnance and the Artillery should be reunited. The new arm would embrace in its duties those enumerated, and which, except the "locating and managing lines of torpedoes," now appertain to either the Ordnance or the Artillery. The Professor is right. The logic of his argument points to but one and that the correct thing. *The Ordnance and the Artillery should be reunited: the whole organized as a Corps of Artillery under the present Chief of Ordnance as Chief of Artillery.* This is the only complete solution of the complex question of the construction, proving, manning and fighting the Artillery. It must result in economy and vastly enhance efficiency of the Public Service.

The Ordnance was merged in the Artillery in 1821. The union terminated after eking out a painful existence of eleven years. This circumstance

is often cited by interested persons to prove the impracticability, with us, of combining the two. Nothing could be more fallacious. Those who are informed regarding the facts know full well that the merging plan of 1821 was a weak expedient to reduce expenses. It did not possess one element of strength. It was made up, warp and woof, of weaknesses. It was not asked for by anybody. There were those, indeed, including the then Secretary of War, who wished to have the Artillery and Ordnance united, but not into the monstrosity that was finally produced. It is wholly an error to suppose that Mr. Calhoun either advocated it or favored it after it was, unhappily, fixed upon by Congress. That it lived eleven years only shows how difficult it is to effect reforms in the Public Service.

The plan of re-organization shadowed forth by the Professor, in the duties he deems proper for the Artillery, and which is here advocated, viz.: the reuniting upon the basis before mentioned of the Artillery and Ordnance, will produce an arm of Service possessing that strength which the merged Artillery of 1821 lacked. By this plan we steer clear of the breakers on which that of 1821 went to pieces. We will have one compact body supervised by a chief, who will regulate artillery affairs in pursuance of law, and not, as the Chief of Ordnance now does to a great extent, merely from force of circumstances. If adopted, it will stand the test of time, for it is logical and consistent in theory, and conforms to true principles.

We cannot better express our conclusions on this whole subject of artillery re-organization than to iterate what we have said elsewhere, and years ago, on the same subject.*

"The remedy for this evil will be applied when the efficiency of that branch of the Public Service becomes a subject for earnest remedial action in either the Councils of the War Department or the Halls of Congress, and may be applied, with various degrees of efficiency, in the following ways:

"(A) Consolidating into a new corps of artillery, and under such restrictions in personnel as will insure efficiency, the present regiments and the Ordnance Department.

"(B) Giving the present regiments a chief, with a competent staff, as contemplated by Mr. Shields.—[S. B. 304. Reported March 23d, 1852.]

"(C) Detailing an officer to act as chief, at the War Department, from among the present personnel of the artillery arm.

" If placing the Service on an enduring basis rather than the convenience of individuals, be an object worthy the solicitude and corrective power of government, the relative merit of these plans is that of the order in which they are enumerated. To strike at the root of existing evils and effect an adjustment as permanent as the present methods of organizing armies, (A) should be chosen; but it must be as indicated heretofore, for otherwise would only be repeated the disastrous experiences that have always attended such attempts. While not so thorough in its operations as (A), the second (B) will give that desideratum first of all in importance—unity of purpose and method in the conduct of artillery affairs—and is preferable to (C) in that the chief would be permanent.

*Historical Sketch of the Artillery, U. S. Army (1884), p. 187.

"Though least desirable, and having within itself fewer facilities for improving the condition of the artillery (C) could not but redound to the great advantage of that arm; and has the recommendation, if facility of execution be counted a merit, that a War Department order is all that is needed to put it into operation, while both (A) and (B) will require an Act of Congress."

Our only sanguine hopes of amelioration are based on the plan (A) above-mentioned, and which is that suggested as proper by Professor Michie. But we do not shut our eyes to the fact that to bring it about, may bear hard on many officers. It is not theoretically right, though it practically seems to be so considered, that the interests of the Government, as embodied in the Artillery Service, should be subordinated to those of individuals. That was the misfortune of the artillery in the re-organizations of 1802 and 1821, and its misfortune when we talk of re-organization now. The artillery was sacrificed t..en, and it will probably be sacrificed now to two considerations: first, the political influence of the inefficient whose only hope of remaining in Service lies in neither intellectual nor professional test for advancement ever being applied to them; second, the vested rights jeopardized on the part of those who might either be retired from Service or injured in their prospects for promotion. Opposition to the plan of reuniting the Ordnance and Artillery results not from belief that it is not of all plans the best, but because it will hurt people. That may or may not be a legitimate reason for opposition; but practically it makes no difference whether the opposition be legitimate or not if it be strong enough to defeat the measure. If, therefore, it be determined that the re-organization proposed is too radical, there remains one plan for uniting the Artillery and Ordnance which is wholly practical, and which leaves the personnel, except the chief of ordnance unaffected; it is this: to pass a law with this simple proviso, "Hereafter the chief of ordnance shall be chief of artillery." Let the new chief, with his hands thus strengthened, work out the solution of the Artillery problem. This would be the beginning of the end before indicated as most desirable of accomplishment.

W. E. BIRKHIMER.

CAMP CHEST.

I.

APRIL 30TH, 1887.

DEAR COLONEL CLOSSON:—Our *Camp Chest* is empty. Why is it so? Did the wit and humor of the Service die with John Phœnix, Ben Beall, John Magruder *et al?*

How would it do for you, as a member of the Publication Committee, to present the subject in next issue for the consideration of your readers and contributors?

Yours sincerely, JAMES B. FRY.

II.

FT. WADSWORTH, N. Y. H., May 2d, 1887.

MY DEAR GENERAL:—A long time ago I wrote to every one I could think of as favorable sources for such light articles as might spice our literary table, and the reply in one instance may serve, perhaps, to indicate a feeling at which I was surprised, and which may possibly be more general than one would suppose. My friend said that he thought "Punch was out of place in the JOURNAL."

There are men we know who need a surgical operation in order to comprehend a joke, and who don't see anything to laugh at in Gen. Porter and Mark Twain, or even Lord Wolseley, and I am beginning to fancy that in this country, in spite of Minister Cox, laughing is going out of fashion.

The Army is getting altogether too scientific. We are in the throes of reform, struggling with tactics of the —nth dimension, with ballistics exterior, interior, and posterior particularly, straining after the maximum amount of promotion in the minimum amount of time, and everybody is too busy to stop for the pleasures either of imagination or memory.

We have exchanged camp-fires for gas-stoves, toddy for beef-tea and the vagaries of our Prince Johns are forgotten amid the calculations of our Prof. Bashforths.

Every subaltern is busy trying to get his immortal soul into the carcass of a Brigadier-General, with the exception of one or two here and there, who prefer the easier task of putting one month's pay into three or more accounts, while the "old officers" have taken to Lithia water and pepsin, determined to fill up the sixty-four years of active life if there is any virtue in salt or acid. There are no more cakes and ale—nothing but complaints and petitions, and that's the reason no fun can be found for the Camp Chest. Very truly yours,

HENRY W. CLOSSON.

OUR EXCHANGES.

[List of Periodicals in Exchange, with titles of leading professional articles.]

BRAZIL.

Revista Mensual. Vol. V., Feb., 1887.

1.—Reylamento del Colegio Miletar.
2.—Ametralladoras generalidades Tecnicas y empleo Tactico.
3.—Instruccion y Educacion Miletar.
4.—Higieno Miletar.
5.—Defensa de costascio Eslados Unidos

[The same, Vol. V., March, 1887.]

1.—Propas de Ingenieros.
2.—La Caridad Del Soldado.
3.—Noticias Militares.

ENGLAND.

Journal of the R. U. S. Institution, Whitehall. Vol. XXX., No. 137, Jan., 1887.

1.—Coast Defense. By Col. Schaw. Pp. 1139.
2.—Small Arms for Field Artillery. By Maj. J. D. Douglass. Pp. 1175.
3.—The Engineer Arm in Continental Armies. By Capt. W. A. H. Hare. Pp. 1229.

Proceedings of the Royal Artillery Institution, Woolwich. Vol. XV., No. 4, Feb., 1887.

1.—The Protection of Heavy Guns for Coast Defense. By Capt. Clarke.
2.—The Nile Expedition of 1885.
3.—The Attack Formation of Infantry. By Lieut.-Col. Macdonell.
4.—Letters on Artillery.
5.—The Use Made of Field Artillery During the War of 1870.

[The same, Vol. XV., No. 5.]

6.—Field Shrapnel Fire. (Hadcock.)
7.—A Narrative of Six Weeks' Siege Operations. (Lamb.)
8.—The Garrison Gunner. (Nash.)
9.—Replacing Disabled Horses in a Team. (Gambier.)
10.—Considerations on the Employment of Horse Artillery in Conjunction with Cavalry. (Translation, May.)
11.—Letters on Artillery. By Prince. Kraft zu Hohenlohe Sugelfingen. Translated by Walford.
12.—Three Letters. The Fire Effect of the Artillery During the War. 1866.

[The same, Vol. XV., No. 6.]

13.—Picric Powder for Guns and Magazine Rifles.
14.—Notes on Ordnance in the Rotunda Museum.

LONDON.

The Illustrated Naval and Military Magazine. Vol. VI., No. 33. March, 1887.

1.—The Prussian Grenadiers of the Seven Years' War.
3.—The Pfund-Schmid Land Torpedo.
4.—Biography of Maj.-Gen. Buller.

5.—Defense of the St. Gothard Tunnel.
6.—The Battles of the British Army Inscribed on the Regt. Colors.
8.—The Mauser Repeating Rifle.
9—The Kruka and Sederl Double Repeating Rifle.
14.—Army Revolver.
15.—Volunteer Organizations, etc.
[The same, Vol. VI., No. 35, May, 1887.]
1.—Russian Soldiers of 1760 and 1813.
2.—Rough Notes on a New Form of Attack.
3.—Modern Tactics. Chapters ii. and iii.

ITALY.

Rivista di Artiglieria e Genio. Vol. I., 1887. Feb'y.
[The same, Vol. I., March, 1887.]
1.—L'Artiglieria a bavallo e le cocche da fuoco a tiro celere.
2.—Questioni Riflettenti l'Artiglieria da Montagna.
3.—S combustibili Fossili i Materiali refrattari e l'Oridustria siderugied all esposizione Nationale di Torino. Feb., 1884.
4.—Con dati Statistici descritt e spoumentali circa le poduzioni in Italia, per L. Adams, Roma, 1886.

INDIA.

Journal of the U. S. Inst. of India. Vol. XV., No. 66, Feb., 1887.
1.—Organization of the Native Army.
2.—The Supply of Ammunition in Action.
3.—The Attack Formation.
4.—The German Army.
5.—The Russian Army.
6.—The Siamese Army.
7.—Cavalry Distance Rides.
8.—Some Remarks on the Supply of Artillery Ammunition in Action.
9.—Hints on Military Landscape Sketching.
Extracts. 1.—Small Arms Ammunition Supply.
2.—The Employment of Dynamite as a Bursting Charge for Artillery Projectiles.

SPAIN.

Memorial de Artilleria. Vol. XV., No. 1, Jan., 1887. Madrid.
1.—The New Austrian Firing Regulation for Field Artillery and those adopted in Spain.
2.—Natural Saltpetre in the Island of Cuba.
3.—Notes for a History of the Casting of Bronze Artillery in Spain.
4.—Santa Barbara (the Patron Saint of the Spanish Artillery).
[The same, Vol. XV., No. 2, Feb., March, April, 1887.]

UNITED STATES.

Southern Bivouac. Vol. IX., No 10, March, 1887. (Louisville.)
1.—The Career of the *Merrimac.* By D B. Phillips.
2.—The Trial of Vallandigham. By J. M. Wright.
3.—The same. Vol. IX., No. 11, April, 1887.
4.—The Fight for Richmond. (Law.)
5.—The Surrender of Fort Donelson. (Casseday.)
6.—The North-west Conspiracy. (Hines.)
[The same, Vol. IX., No. 12.]
7.—The Fight for Richmond in 1862. (Law.)
8.—Donelson's Charge at Stone River.

Johns Hopkins University. (Baltimore.)
American Journal of Philology. Vol. VII., No. 4.
Studies from the Biological Laboratory. Vol. III., No. 9.
Johns Hopkins University Circulars. Vol. VI., No. 56, March, 1887.

American Chemical Journal. Vol. IX., No. 1.

Estimations of Carbonic Acid in the Air. (Van Nuys and Adams.)

The City Government of St. Louis. (Snow.)

American Chemical Journal. Vol. IX., No. 2.

The Pennsylvania Magazine of History and Biography. Vol. XI., No. 1, April, 1887. (Phila.)
1.—The Siege of Fort Mifflin.
2.—Gen. Braddock's Campaign.
3.—Battle of Germantown from a British Account. (Potts.)
4.—Letters of Gen. Anthony Wayne.

Weekly Times. Vol. II., No. 2, Saturday, Feb. 26, 1887. (Philadelphia.)
1.—First and Last. The place where the Confederacy began and ended. Abbeville and its History.
2.—Confederate Documents that were lost and have been found. A Secretary's Council's Efforts to Effect Strategic Points in North-west Virginia.
3.—The same, March 5, 1887.
4.—Reunion of Baker's Brigade, and
5.—Picket's Division.
6.—Grant's Famous Dispatch—alleged to have been dictated by Secretary of War Stanton.
7.—Rifle Shooting. The four methods with their variations, etc.
8.—The Famous Wild Cat Regiment in the Civil War. (105th Penn. Vols.) Same March 19, 1887.

The Book Mart. Vol. IV., 1887. March, 1887. (Pittsburgh.)
[The same for April and May, 1887.]

Appleton's Literary Bulletin. (New York.)

Book Chat. Vol. II., No. 2, Feb., 1887.

Bulletin of the American Geographical Society, Nos. 4 and 5, 1885. (New York.)
1.—Historical and Geographical Features of the Rocky Mountain Railroads. By James Douglas. No. 4.
[The same, No. 3, 1886.]
2.—Over the Mexican Plateau in a Diligence.

Grand Army Review. Vol. II., No. 10, March, 1887. (New York.)

Fort Sumter. (Scheibner.)
[The same, April and May, 1887.]

Harper's New Monthly Magazine. Vol. LXXIV., No. 442, March, 1887. (New York.)
2.—The New York Police Department. By Richard Wheatley.
[The same. Vol. LXXIV., No. 443, April, 1887.]
[The same. Vol. LXXIV., No. 444, May, 1887.]

Ours. 23d Regt., N. G. S., N. Y. Vol. I., No. 4. (New York.)
2.—The Army and the People. By Lt. W. R. Hamilton.
[Vol. I., No. 5, April, 1887.]
1.—The Army and the People. (Hamilton.)
2.—Rifle Range. (Greenland.)
[The same. Vol. I., No. 6, May, 1887.]
1.—The Army and the People. (Hamilton.)
2.—A Reminiscence of the War Times. (Capt. Bassett.)

Outing. Magazine of Recreation. Vol. IX., No. 6, March, 1887. (New York.)
1.—After Geronimo, XIII. By Lt. John Bigelow.
[The same, April, 1887.]
1.—After Geronimo, XIV.
[The same, May, 1887.]

Political Science Quarterly. Vol. II., No. 1, March, 1887. (New York.)
1.—The Greenback in War. (Powers.)
2.—Louis Riel's Rebellion. (Rambaut.)

Magazine of American History. Vol. XVII., No. 3. (New York.)
[The same. Vol. XVII., No. 4.]
1.—The Fall of Fort Duquesne. (Chapman.)
[The same. Vol. XVII.]

Popular Science Monthly. Vol. XXX., No. 6, April, 1887. (New York.)
1.—A Remarkable Explosion. (Griffin.)
[The same, May, 1887.]
1.—Hygiene as a Basis of Morals. (White.)
2.—William Babcock Hazen. (Prof. Abbe.)

School of Mines Quarterly. Vol. VIII., No. 2, January, 1887. (New York.)
6.—Our Grandest Mountain and Deepest Forest. By Bailey Willis.

Science. Vol. IX., No. 212, February, 1887. (New York.)
[Same. Vol. IX., No. 213-223, 1887.

Scribner's Magazine.
1.—Modern Aggressive Torpedoes. (Lt. Hughes.)
2.—Reminiscences of the Siege and Commune of Paris. 4th concluding paper. (Washburne.)

The Century. Vol. II., No. 6, April, 1887.
1.—Abraham Lincoln. A History. (Nicolay & Hay.) Chickamauga. The Great Battle of the West. (Hill.) Memoranda on the Civil War.
[The same, May, 1887.]
2.—Among the Apaches. (Schwatka.) The Deserter. (Anthony Morehead.) Abraham Lincoln.
3.—A History. (Nicolay & Hay.) The Campaign for Chattanooga. (Rosecrans.) The Army of the Cumberland at Chattanooga. (Fullerton.) Memoranda on the Civil War.

The Forum. Vol. III., No. 2.
9.—Practical Use for a Balloon. (King.)
[Same, Vol. III., No. 3, May, 1887.]
8.—A New Executive Department.

The Railroad and Engineering Journal. Vol. LXI., No. 3, March, 1887. (New York.)
1.—Steel for Heavy Guns. P. 100.
2.—Re-organizing the Signal Service. P. 123.
[The same, Vol. LXI., No. 4.]

Miscellaneous Articles.
1.—Steel: Its Properties. Its Use in Structures and in Heavy Guns. (Metcalf.)
2.—The New Naval Vessels Authorized.
3.—The English 110-Ton Gun.
4.—Coast Defenses. (Abbot.)
5.—Gunboats.
6.—Modern Warships.
[The same Vol. LXI., No. 5.]
1.—The New War Ships.
2.—Trial of a New Torpedo Gunboat.

The North American Review. Vol. CXLIV., No. 3, March, 1887. (New York.)
3.—Drury's Bluff and Petersburg. By Gen'l G. T. Beauregard.
7.—Some Unpublished War Letters: Secretary Chase, Generals Grant, Halleck. F. P. Blair and Admiral Porter addressed to Gen'l W. T. Sherman.
10.—A rejoinder to Gen. Beauregard. By Rear-Admiral W. R. Taylor.
12.—The South in the Union Army. By A. P. Morey.
[The Same, Vol. CXLIV., No. 4, April, 1887.]
6.—Some More War Letters. (Bragg.)
The Same. May, 1887. Grant, Thomas, Lee. (Sherman.)

Transactions of the American Society of Civil Engineers. New York. Vol. XV.
344.—The American Line from Vera Cruz to the City of Mexico *via* Jalapa, with Notes on the best methods of submounting high elevations by rail. By A. M. Wellington.
[The Same, Vol. XV., Dec., 1886.]
[The Same, Vol. XVI., February, 1887.]

Transactions of the American Society of Mechanical Engineers. Vol. I.—VII. 1880—1887. From the Society.
1.—The Basic Bessemer Process. Vol. VII., p. 34.
2.—Crystallization of Wrought Iron. By Wm. Hill. Vol. VII., p. 24.
[Vol. II., 1881.]

Army and Navy Register. Vol. VII., 1887, No. 10. Washington.
1.—Machine Guns. P. 149.

2.—Firing of the 110-Ton Gun. P. 157.
3.—The 8-inch Steel Rifle. P. 158.

Hudson's Army and Navy List. March and April, 1887. (Washington.)

United States Government Publications. Monthly Catalogue. Vol. II., Nos. 7–12. 1886.

Monthly Weather Review.

Southern Historical Society Papers. Vol. XIV., January-December, 1886. (Richmond.)
1.—Annual Reunion of Pegram Battalion Association.
2.—Diary of Lt.-Col. John G. Pressley.
3.—Ceremonies at Unveiling of Statue of Gen. Lee.
4.—First Maryland Campaign. Review of General Longstreet. By Col. W. Allen.
6.—The Confederate Steamship *Patrick Henry.*
7.—Reminiscences of Field Ordnance Service with the Army of Northern Virginia, 1863–65.
8.—Report of the Conduct of General Geo. H. Steuart's Brigade from the 5th to the 12th of May, 1864, inclusive.
9.—Death of Stonewall Jackson.
13.—Memoranda of 28th Virginia Infantry.
14.—President Davis in Reply to General Sherman.
15.—Battle of Chancellorsville. By Col. Theo. A. Dodge.
16.—Brigadier-General Robert Toombs.
17.—Fortifications and Siege of Port Hudson.
19.—Ewell at First Manassas.
20.—Stonewall Brigade at Chancellorsville.
23.—Chickamauga. By Major W. W. Carnes.
25.—Recollections of Fredericksburg from the Morning of the 20th of April to the 6th of May, 1863. By Gen. Humphreys.
26.—Maryland Confederate Monument at Gettysburg.
27.—Building Confederate Vessels in France.
29.—General Stuart's Expedition into Pennsylvania.
32.—Campaign from the Wilderness to Petersburg.
33.—Campaign of 1864–1865. Narrative of Maj.-Gen. C. W. Field.
34.—Long's Memoirs of Gen. R. E. Lee.
35.—Field Telegrams from Around Petersburg.

The Public Service Review. Vol. I. 1887. (New York.)

No. I.

1.—American-built Ships. (Porter.)
2.—Possibilities of Dynamite. (McKee.)
3.—Co-operation in the Public Services. (King.)
4.—The Artillery Problem. (Buell.)
5.—Citizen Soldiers in the West.
6.—Social Life at Service Stations. (Fort Monroe.)
7.—The Post Mess Experiment (with diagram).

No. II.

8.—Possibilities of Dynamite. (McKee.)
9.—The Green Mountain Boys.
10.—The General and Journalist in Time of War.
11.—A Famous Sanitarium. (St. Augustine.)
12.—Torpedoes for Naval Use.

No. III.

13.—Modern Marine Engine. (Griffin.)
14.—Army Signaling and Telegraphy.
15.—Naval Education Abroad.
16.—The Club and the Company. (Militia.)
17.—Military Art Past and Present. (Trumble.)
18.—Riding to Hounds as a Military Sport. (Roosevelt.)
19.—The Immediate Future of Naval Warfare. (Chambers.)
20.—National Guard Questions.
21.—Navy Administration.

No. IV.

22—Army Officers at Colleges. (Lockwood.)
23.—Queen Victoria at the Grande Chartreuse.

24.—Training of Naval Officers. (McCalla.)
25.—Office and Rank.
26.—The Personnel of the Navy.
27.—Social Life at Service Stations. (Norfolk.)

No. V.

28.—Immediate Modifications in our Navy Yards. (Stockton.)
29.—The Encampment and Drill at Washington (Critical Report).
30.—The Modoc War. (Jackson.)
31.—Preliminary Training for the Cavalry. (Hardie.)
32.—The *Pocahontas*. (Connelly.)
33.—Artillery Needs and Aspirations.

No. VI.

34.—Naval Vessels. (MacConnell.)
35.—Canadian Frontier Defense.
36.—Military Inventions.
37.—Practice March with Light Battery F, 5th Artillery. (See Nos. VII., VIII. and IX.)

No. VII.

38.—The Training of Seamen. (Chadwick.)
39.—Practical Instruction in Minor Tactics. (Wisser.)
40.—City Quarters for the Services.
41.—Burgoyne's Battle-flags. (Cullum.)
42.—Roll-call at Sunset. (A Reverie.)
43.—The Pipe of Opium. (Translation.)

No. VIII.

44.—Our Navy. (Cooke.)
45.—U. S. Revenue Cutter Service.
46.—Camp at Peekskill.
47.—How Battle-Flags are Captured.
48.—The Battle-Flag Episode.